

# **IDENTIFYING AMMUNITION**

## **Subcourse MM 2598 Edition 7**

**United States Army Combined Arms Support Command  
Fort Lee, Virginia 23801-1809**

**4 Credit Hours**

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## INTRODUCTION

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In the preceding subcourse (MM2597), you learned how to interpret ammunition markings and color codes. Now suppose, for example, a using unit turns in ammunition that has been removed from its original containers and there are no markings or the markings have been obliterated. How are you going to determine what the ammunition is? If the color code paint is still present, you may know that it is high-explosive ammunition; but how can you tell if it is a mortar round, a rocket, or an artillery projectile?

Positive identification of ammunition is of vital importance to an ammunition specialist. If you issue the wrong ammunition item or place the wrong types of ammunition together in a storage stack, the results could be disastrous. This subcourse is designed to teach you methods of quick identification by type and use (by physical characteristics) of all types of ammunition items.

**Tasks.** This subcourse consists of one lesson based on the following tasks from STP 9-55B12-SM:

- 093-400-1100, Identify Fuzes.
- 093-400-1101, Identify Artillery Ammunition.
- 093-400-1102, Identify Mortar Ammunition.
- 093-400-1103, Identify Small Arms Ammunition.
- 093-400-1104, Identify Grenades.
- 093-400-1105, Identify Mines.
- 093-400-1106, Identify Small Guided Missiles.
- 093-400-1107, Identify Demolition Material.
- 093-400-1108, Identify Pyrotechnics.
- 093-400-1109, Identify Rockets.

**Objective.** When you have completed this subcourse, you should be able to identify ammunition items by type and use.

**Conditions.** You will have this subcourse book and will work without supervision. There are no supplementary requirements in material or personnel for this subcourse.

**Standard.** You must score at least 70 on the end-of-subcourse examination (answer 19 of the 25 questions correctly).

**Credit Hours.** Four credit hours will be awarded for the successful completion of this subcourse.

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## IDENTIFICATION OF AMMUNITION

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### UNDERSTANDING MEANS OF IDENTIFICATION

All ammunition items can be identified by using one or a combination of the following: size, shape and physical features, color code, markings, packing, and type.

#### Size

All ammunition that is fired through the bore of a weapon has a specific measurement designating its diameter size. Measurements used in ammunition include caliber, inches, millimeters, and weight.

**Caliber.** An old method of sizing ammunition, the term "caliber" is used to designate size in inches. Caliber .50, for example, indicates that the ammunition measures approximately .50 inch.

**Inches.** Another old method of sizing ammunition-when the diameter is larger than one inch.

**Millimeters.** The modern, standardized means of measuring ammunition size. The size previously designated as caliber .30, for example, is now 7.62 millimeters. There are 25.4 millimeters to an inch, so 7.62 millimeters equals .3085 inch-same as caliber .30.

**Weight.** Some ammunition items are designated by weight. For example, demolition explosive charges and aircraft bombs may vary in size, but their official measurement is designated in pounds.

#### Shape and Physical Features

Ammunition items that can not be designated effectively by size or weight must be identified by shape and special identifying characteristics. Examples are land mines, firing devices, and pyrotechnics.

#### Color Code

Various colors are used when painting ammunition. Specific colors are used to indicate fillers, effects, and purposes. For example, yellow means high-explosive, and black means armor-defeating. A combination of several color codes may be used on the same item.

#### Markings

Most ammunition will have letters and numbers stenciled on the item in the respective color code. Since space is limited on ammunition items, a system of standard abbreviations and numbering is used.

## Packing

Most ammunition items can be identified while still in their containers. Some containers are unique in size and shape, but all containers bear markings using the standard marking system.

## Type

Ammunition items are also categorized and identified by type. All ammunition items in this subcourse fall into one of the following categories: small arms, artillery, rockets, hand grenades, land mines, fuzes, small guided missiles, demolitions, and pyrotechnics.

## IDENTIFYING SMALL ARMS AMMUNITION

Small arms ammunition is ammunition fired from pistols, revolvers, shotguns, rifles, and machine guns ranging in size from .22 caliber through 30mm. A complete small arms cartridge, or round, consists of a cartridge case, the propellant, the primer, and a bullet. See Figure 1.

**Cartridge Case.** The cartridge case has three functions: (1) It is the main part of the cartridge, with the primer, propellant, and bullet assembled into it. (2) It provides a waterproof container to protect the propellant. (3) It serves as a seal in the weapon by expanding when the weapon is fired, thus preventing gases from escaping to the rear.

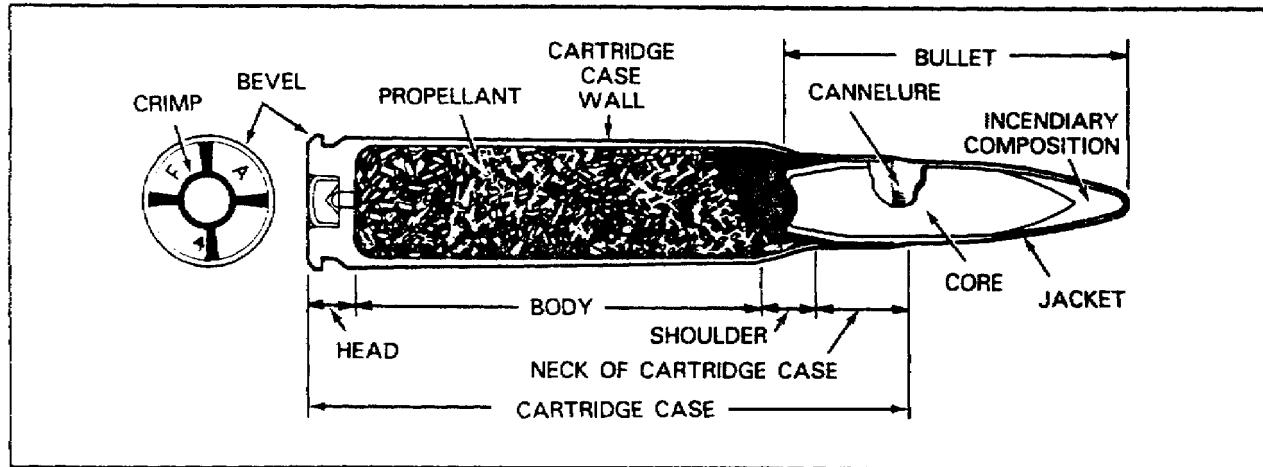


Figure 1. Cross Section of a Typical Small Arms Cartridge.

**Propellant.** The propellant in small arms cartridges is low-explosive propellant grains (sometimes mistakenly called powder). When ignited, the propellant burns, producing rapidly expanding gases. These gases propel the bullet through the barrel of the weapon at a high rate of speed.

**Primer.** The primer is what ignites the propellant. The primer contains a very small amount of sensitive explosive. It makes a very small explosion to ignite the propellant when hit by the firing pin of the weapon.

**Bullet.** The bullet is the part of the cartridge that strikes the target. There are various types of bullets designed for use on different kinds of targets. Some types of small arms cartridges do not have bullets. The

shotgun shell, for example, may contain a number of shot pellets instead of a bullet. In small arms cartridges of 20mm and larger, the bullet is called a projectile.

### Size of Small Arms

As noted previously, caliber designation is a method of sizing ammunition. Caliber, however, is also used to designate the diameter size of the bore of a weapon measured from one land (raised portion of the grooved surface) to the land directly opposite. The caliber of a weapon, like ammunition caliber, is expressed in inches or millimeters-millimeters for weapons that have been developed in more recent times. See Figure 2. The bore diameter of a .22 caliber weapon measures .22 inch, the bore diameter of a .50 caliber weapon measures .50 inch, and the bore diameter of a .30 caliber or 7.62mm weapon measures .30 inch or 7.62mm. To compensate for the lands in the bore of a weapon, the ammunition used must be slightly larger in diameter than the bore. Caliber .22 ammunition is actually .225 inch in diameter, caliber .50 is .5110 inch in diameter, and caliber .30 (7.62mm) ammunition is .3085 inch (7.62mm) in diameter. See Figure 3. Note that the caliber of the ammunition illustrated is the size of the diameter of the bullet only. The cartridge case is not involved in the measurement.

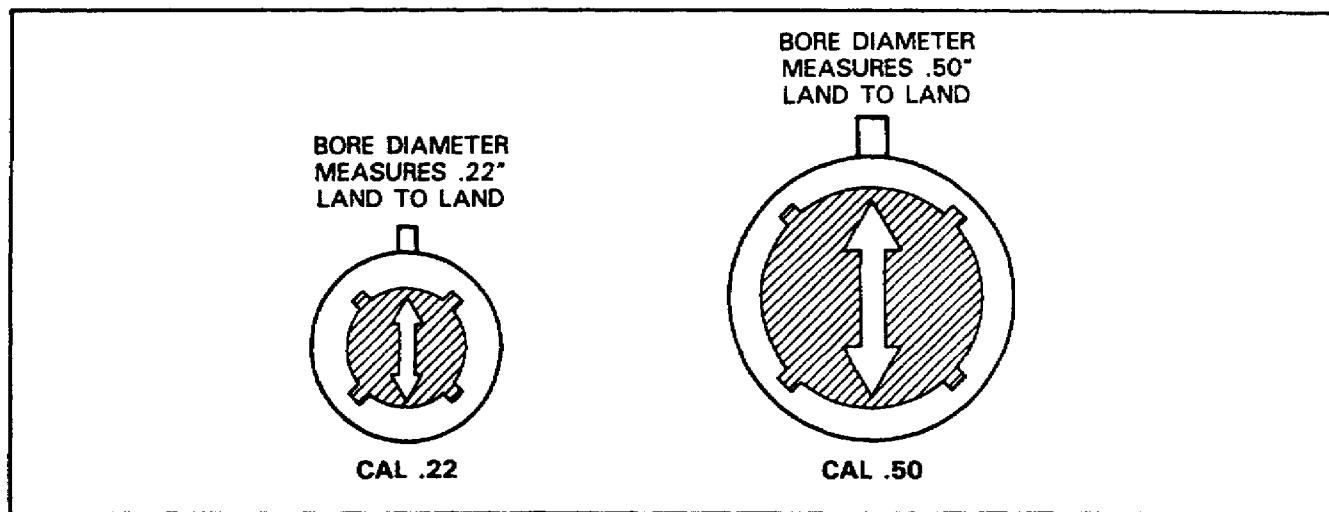


Figure 2. Caliber of Weapon Bores.

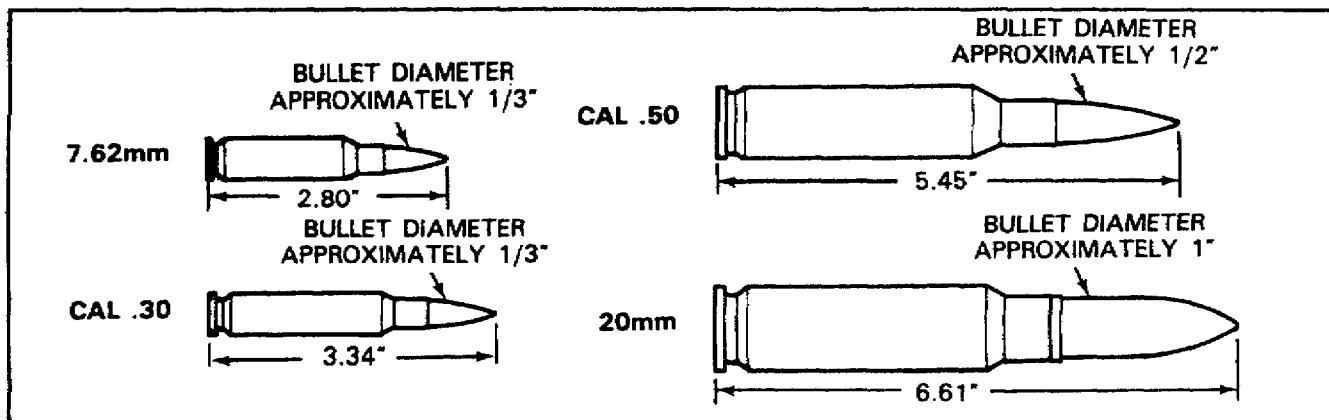


Figure 3. Comparison of Cartridges.

### Types of Small Arms Cartridges

Small arms cartridges can be divided into two major categories by use—for combat and training and for training only.

**Combat and Training.** Small arms cartridges in this category are commonly known as service rounds. They include ball, tracer, armor-piercing, incendiary, and other types of cartridges. See Figure 4.

**Ball.** "Ball" means that the bullet is used against personnel and unarmored targets. The bullet is a metal jacket with a lead slug inside. The ball cartridge is easily identified by the natural bronze finish of the bullet jacket.

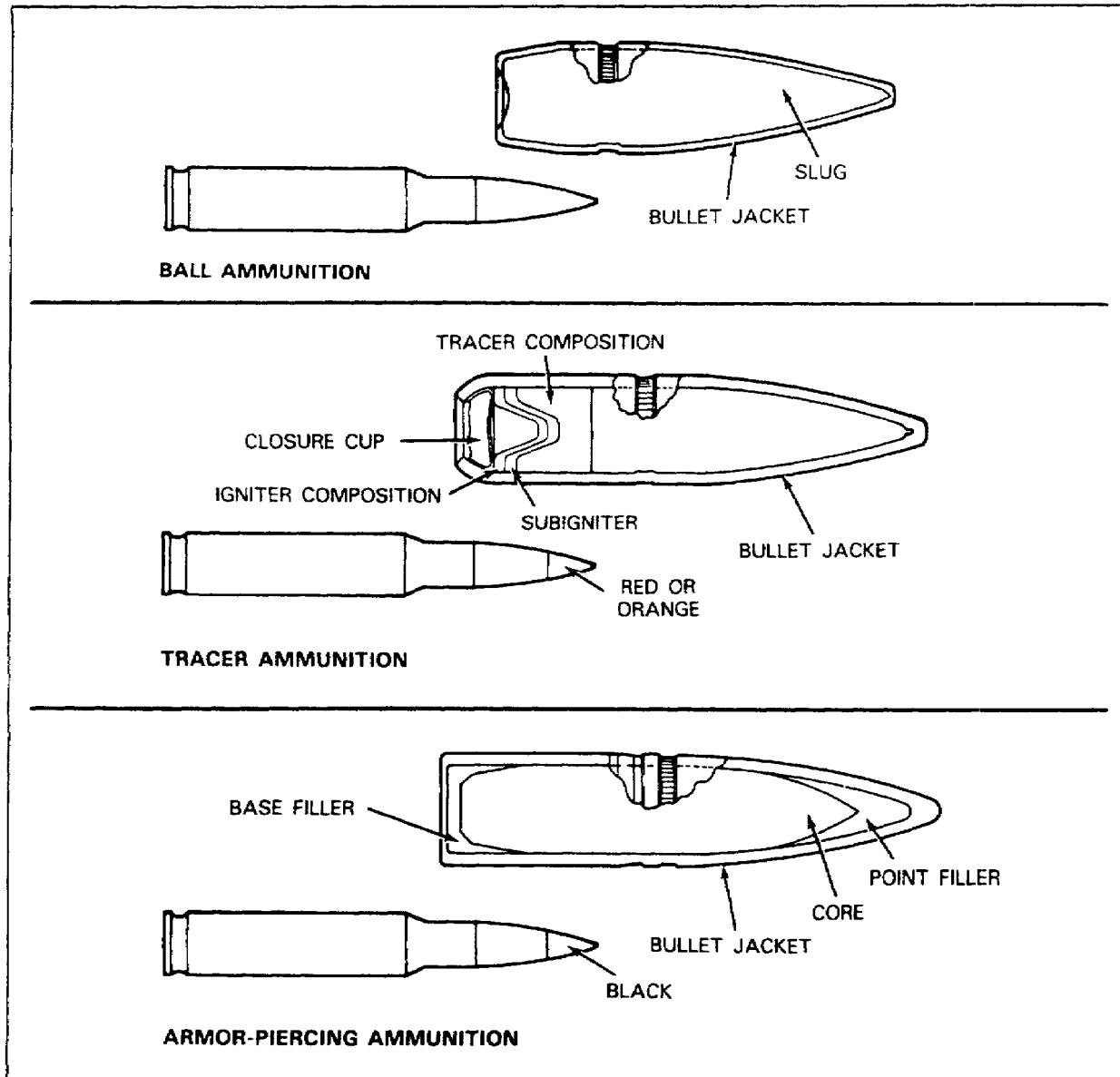


Figure 4. Comparison of Basic Cartridge Types.

**Tracer.** The tracer round is used to show a bullet's flight path in a trail of flame and smoke. The tracer bullet contains in its base a flammable material that is ignited by the propellant when the round is fired. This tracer element burns with a bright flame that is visible to the gunner. The tracer round is identified by a red or orange tip on the bullet.

**Armor-Piercing.** The armor-piercing round is used against personnel, unarmored targets, and light armored targets. The bullet is a metal jacket with a hardened steel core. The remaining space is usually filled with lead.

**Incendiary.** The incendiary round is used to ignite combustible targets, such as fuel tanks. The incendiary bullet contains a compressed incendiary mixture that ignites upon impact. The incendiary round is identified by a blue tip on the bullet.

**Other Types.** Other types of small arms cartridges consist of combinations of the basic types. Some examples include: armor-piercing-incendiary, armor-piercing-incendiary-tracer, high-explosive-incendiary (20mm and 30mm only), and high-explosive-incendiary-tracer (20mm and 30mm only).

**Training Only.** The most common cartridges used for training only are blank, dummy, and practice cartridges.

**Blank.** The blank cartridge is distinguished from other cartridges by the absence of a bullet. The blank is used for simulated firing. It consists of a cartridge case, primer, propellant, and a means of sealing the open end. Blank cartridges of various sizes may be distinguished by the different methods of sealing the open end. See Figure 5. Note that the 5.56mm blank has a seven-petal crimp to close the end and a crosshatch band for identification purposes. The 7.62mm blank has an elongated neck and a lacquer seal. The caliber .50 blank has a paper wad seal and a seating groove.

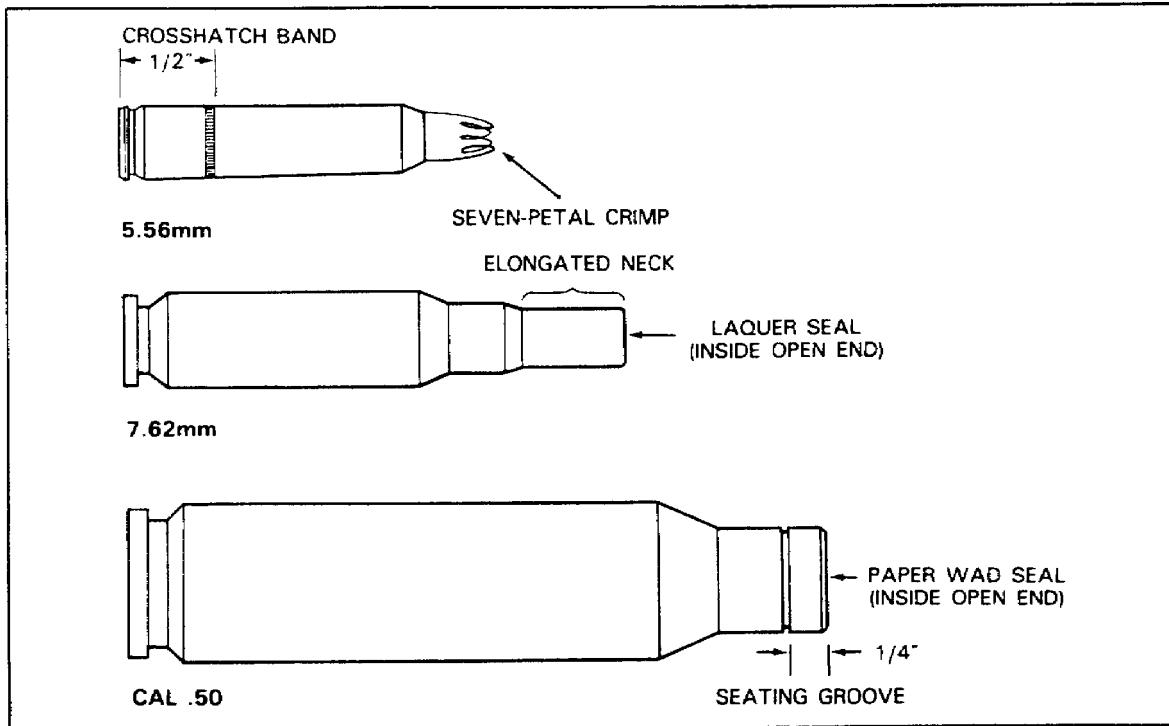


Figure 5. Comparison of Blank Cartridges.

*Dummy.* The dummy cartridge is used for practice in loading weapons and testing weapon functions. These cartridges are completely inert. A dummy cartridge is easily identified by the six grooves in its cartridge case (7.62mm and 5.56mm) or the three holes drilled in its cartridge case (caliber .45 and caliber .50). See Figure 6. Dummy cartridges for testing weapon functions are called dummy, inert-loaded, because they are filled with a simulated propellant to make them the same weight as a service cartridge. They are identified by their overall black finish; they have no grooves or holes.

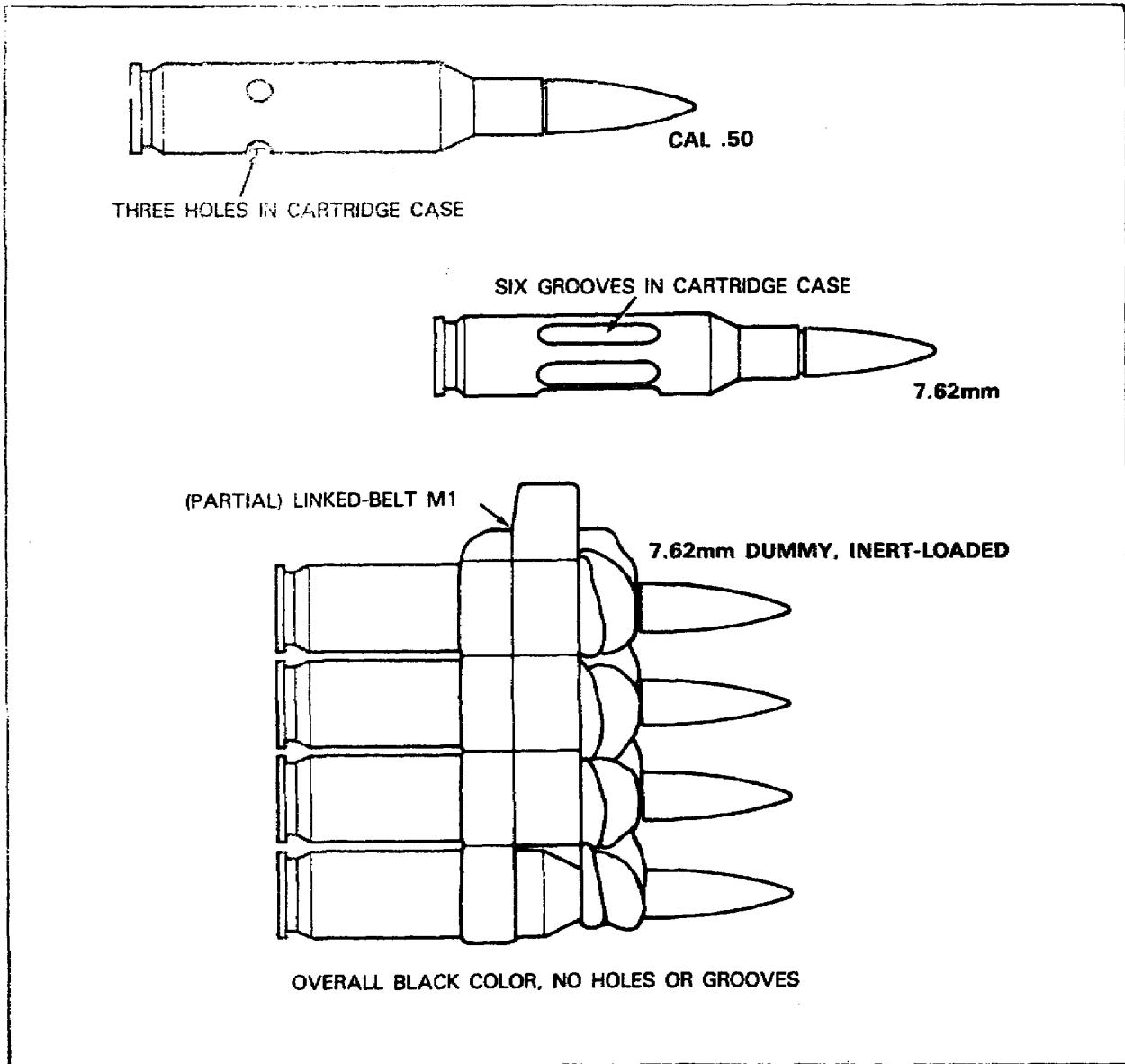


Figure 6. Identification of Dummy Cartridges.

*Practice.* The 5.56mm practice cartridge (Figure 7) is made of plastic and has a blue bullet tip. It is used with the M16A1 rifle with a practice bolt for training in areas where range size precludes the use of full-range standard service ammunition.

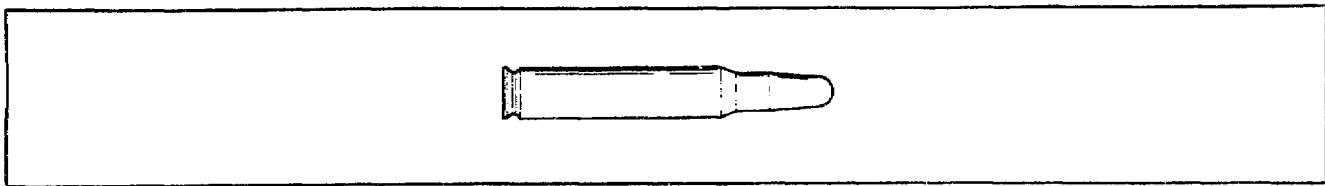


Figure 7. Practice Cartridge.

### IDENTIFYING ARTILLERY AMMUNITION

Artillery ammunition is ammunition designed for use in guns, howitzers, mortars, or recoilless rifles larger than 30mm. (Because of its unique features, mortar ammunition will be discussed separately.) Artillery ammunition can be classified by use and by loading method.

#### Use

All artillery ammunition is classified by intended use (purpose) as service ammunition, practice ammunition, blank ammunition, or dummy ammunition.

**Service Ammunition.** Service ammunition (Figure 8) is used for combat and live-fire training. Service ammunition can be further classified as: high-explosive (HE), antipersonnel (apers), high-explosive rocket-assisted (HERA), high-explosive antitank (HEAT), armor-piercing (AP), armor-piercing discarding sabot (APDS), chemical (smoke or gas), illuminating (parachute flare, base-ejected), or leaflet (countermeasure). The type of service ammunition is identified by color code and markings. Ammunition of uncertain identity will not be issued.

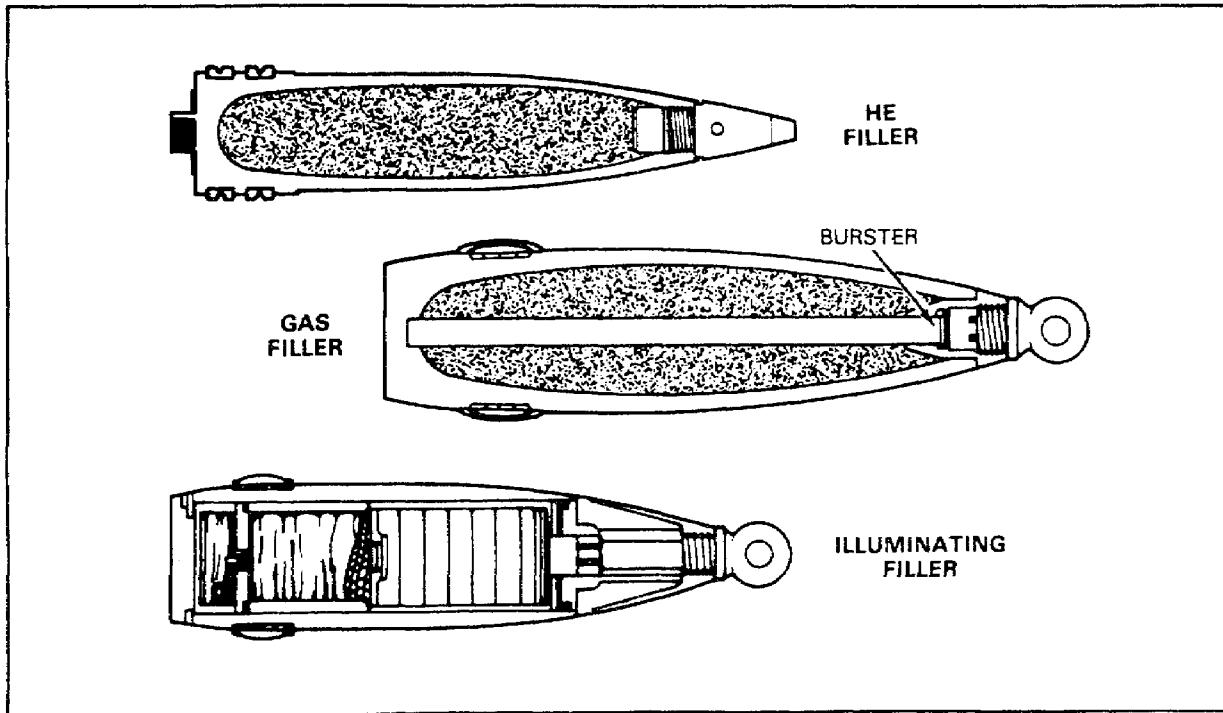


Figure 8. Examples of Artillery Service Ammunition.

**Practice Ammunition.** Practice ammunition is used for training in firing and target practice. These rounds simulate service rounds in weight, configuration, and ballistics. Most practice rounds contain a small explosive spotting charge. See Figure 9.

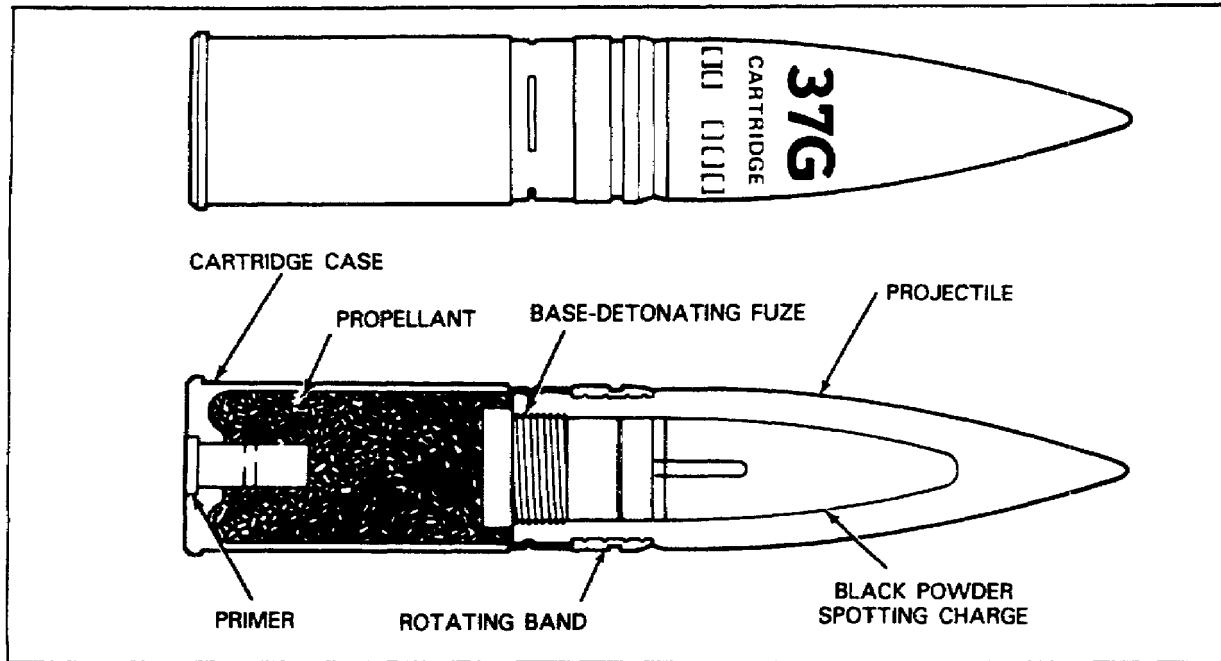


Figure 9. Practice Artillery Ammunition.

**Blank Ammunition.** This type of ammunition is used for simulated fire and ceremonial firing. The most common blank artillery round is currently the 105mm, which consists of a short cartridge case, a primer, and a small black powder charge. See Figure 10.

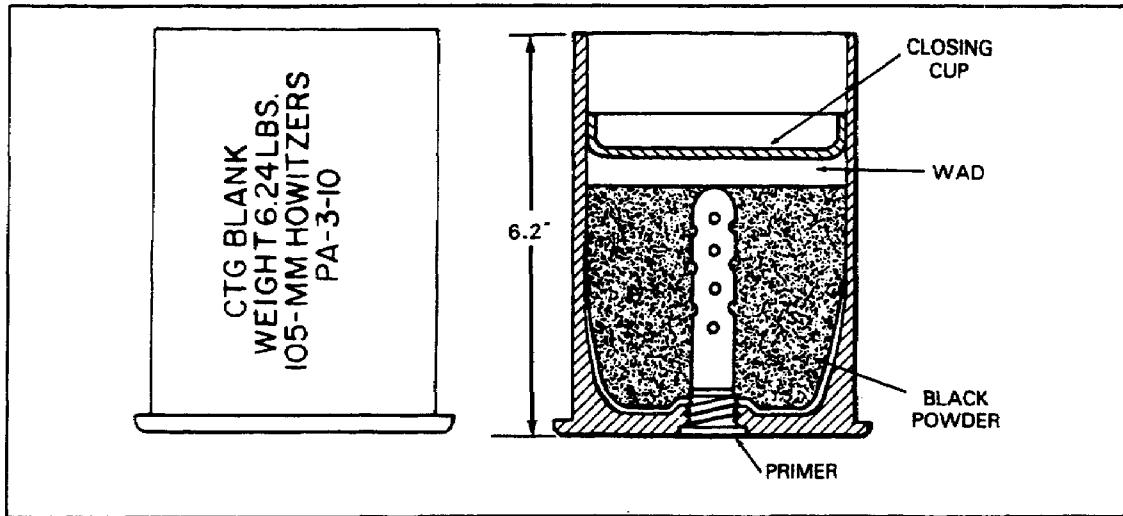
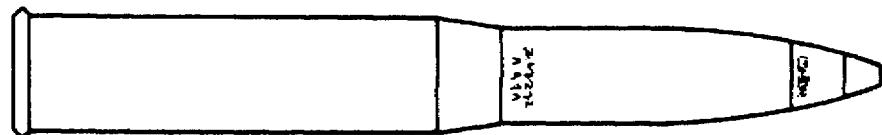


Figure 10. Blank Artillery Ammunition.

**Dummy Ammunition.** Dummy ammunition is often referred to as drill ammunition. It is used for training gun crews in handling ammunition and loading weapon systems. It is also used in exhibits, displays, and other training operations. This ammunition looks like the actual item, but it contains no explosives or other internal components. See Figure 11.

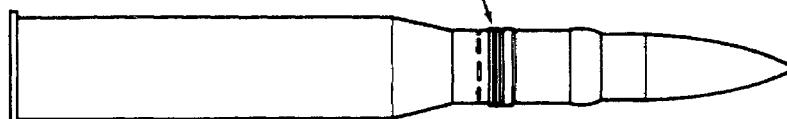
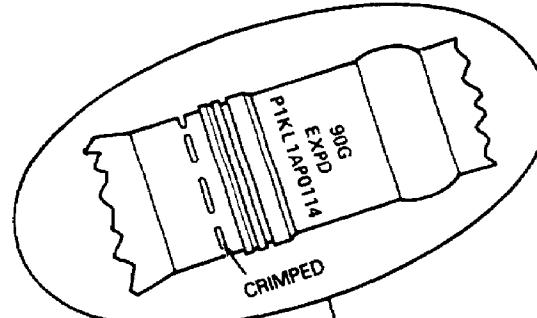


*Figure 11. Dummy Artillery Ammunition.*

#### Loading Method

Artillery ammunition is classified by loading method as fixed, semifixed, separated, or separate loading.

**Fixed Ammunition.** Used in guns and recoilless rifles, this type of ammunition is issued and loaded as a complete unit. The most prominent feature for identification is a cartridge case crimped onto a projectile. See Figure 12.



*Figure 12. Fixed Artillery Ammunition.*

**Semifixed Ammunition.** Used in howitzers, this type of ammunition is issued with the cartridge case and propellant separate from the projectile but in the same container. The cartridge case fits loosely over the base of the projectile before firing so the firing unit can adjust the amount of propellant to obtain the desired range. See Figure 13.

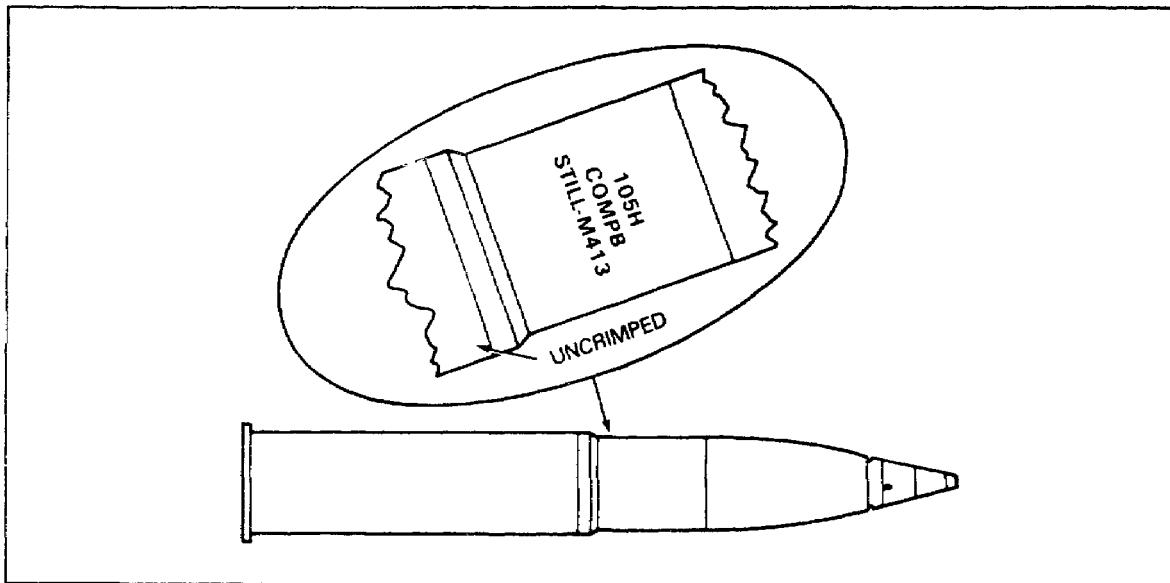


Figure 13. Semifixed Artillery Ammunition.

**Separated Ammunition.** Used in large guns, this type of ammunition is issued in two separate components, a sealed cartridge case and a projectile. Although there is no separated artillery ammunition in US Army stocks at this time, it is used by our allies and our ammunition personnel must be able to identify it. See Figure 14.

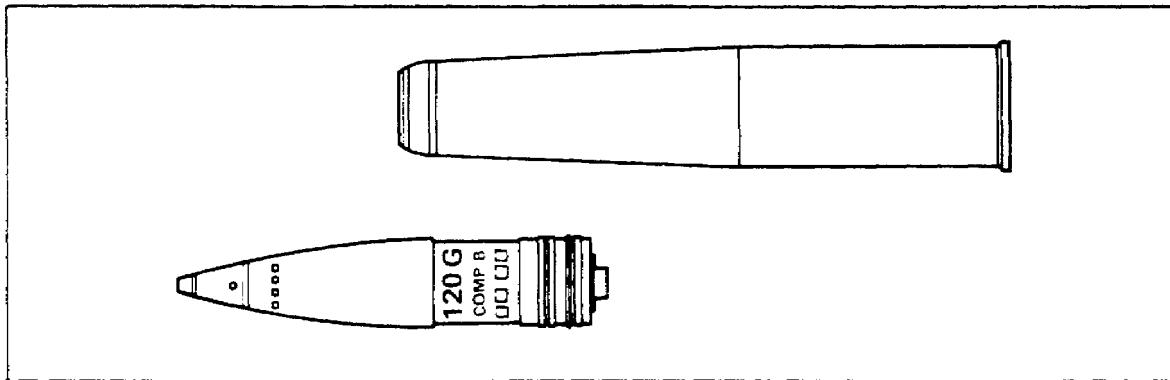


Figure 14. Separated Artillery Ammunition.

**Separate Loading Ammunition.** Used in larger guns and large howitzers, the components of a complete round are a fuze, a projectile, a propelling charge, and a primer. These components are required to fire the round once, and they are issued separately. (Before the round is fired, the eyebolt lifting plug must be removed from the projectile and a fuze must be installed in its place. The fuzed projectile, propelling charge, and primer are then

loaded into the weapon separately. The propelling charge is divided into increments to adjust the range.) See Figure 15.

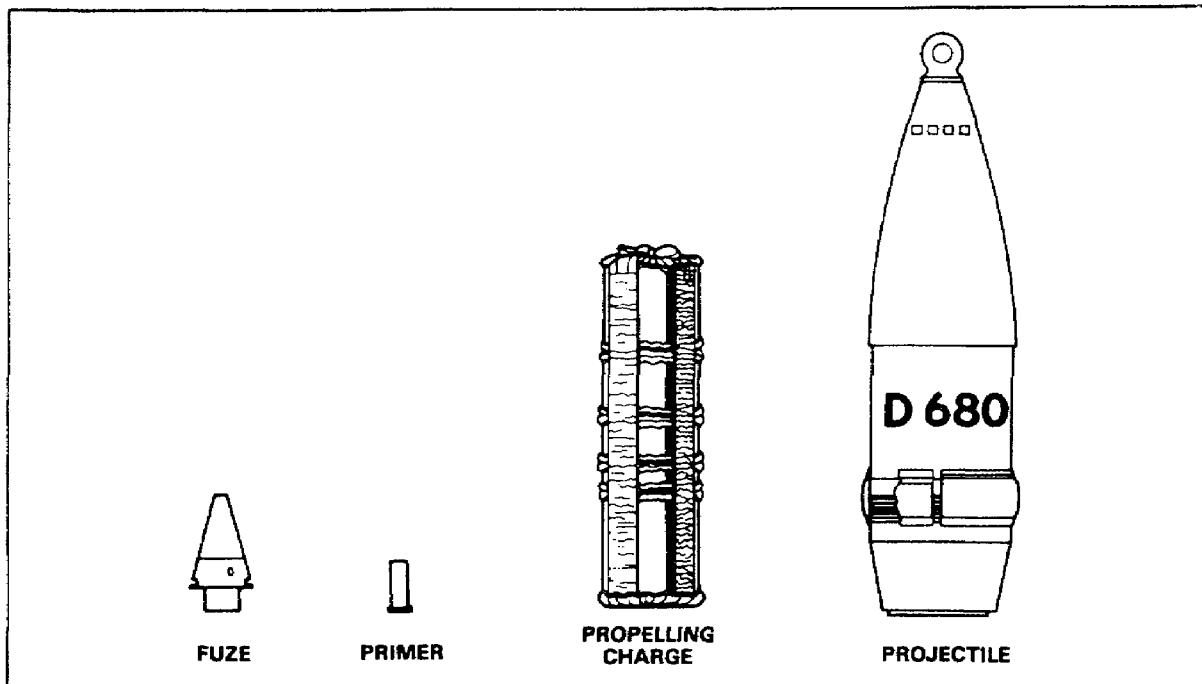


Figure 15. Separate Loading Artillery Ammunition.

#### Additional Identifying Features

Artillery ammunition has several unique additional features that can help in identification, including: rotating bands, eyebolt lifting plugs, closing plugs, and perforated cartridge cases (see Figure 16).

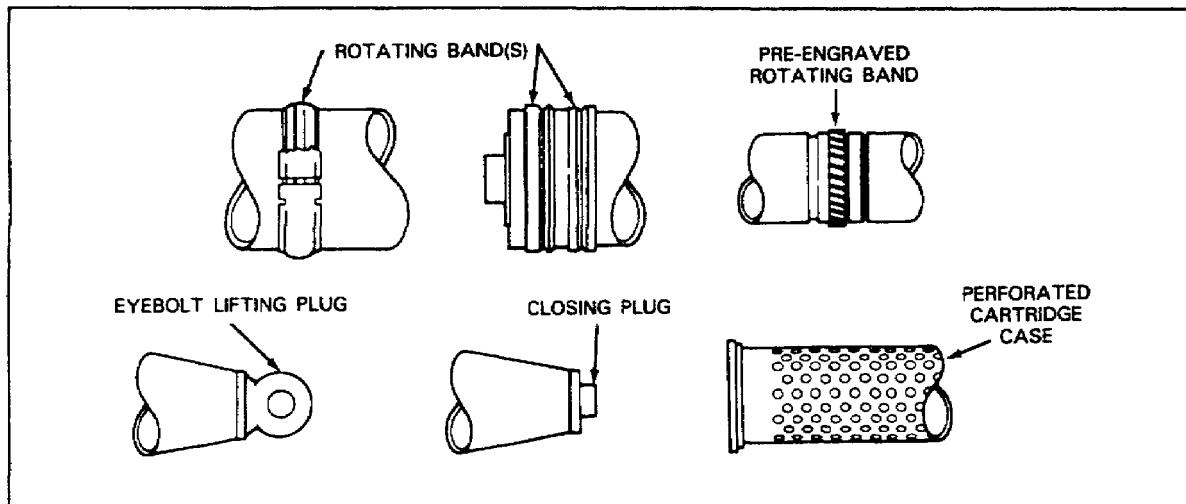


Figure 16. Identification Features of Artillery Ammunition.

**Rotating Bands.** Rotating bands are bands of soft metal that engage the rifling of the bore of the weapon upon firing. This causes the projectile to spin and stabilize in flight. Rotating bands also identify the type of ammunition according to the type of weapon used (see Figure 17).

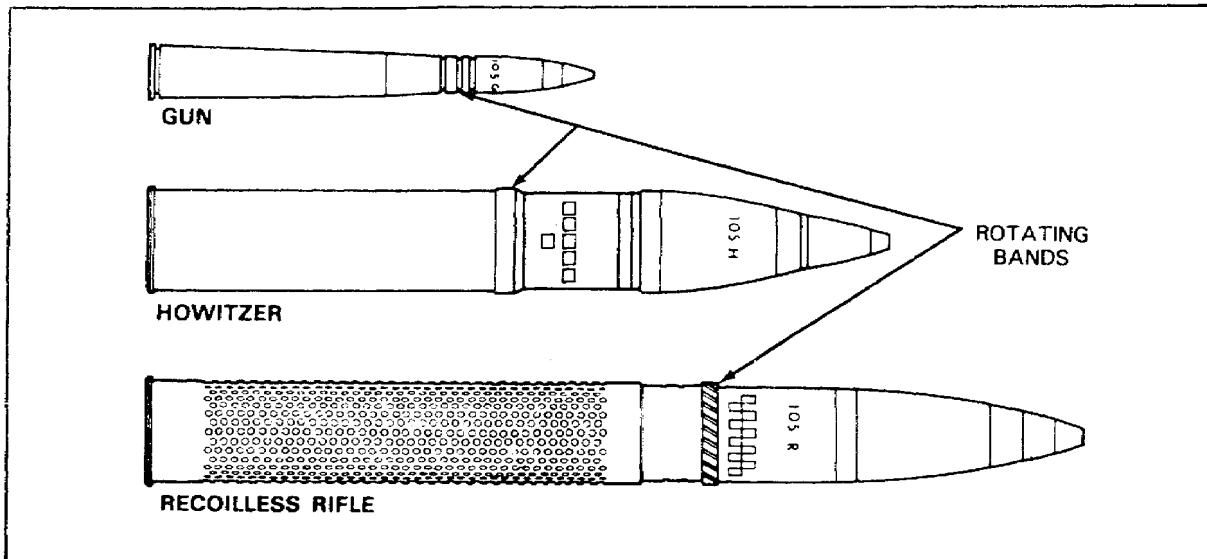


Figure 17. Comparison of Rotating Bands by Weapon Type.

The *howitzer* has a short tube, comparatively short range, and a high angle of fire. Therefore, it has only one narrow rotating band. The *gun* has a proportionately longer tube, a flatter trajectory, and higher velocity than a howitzer. Therefore, a gun round may have two narrow rotating bands or one wide rotating band. The *recoilless rifle* is fired under lower velocity for shorter ranges than the gun. Therefore, this round may have a pre-engraved rotating band for less resistance in the tube. The rotating band has grooves cut in it by the manufacturer. These grooves mesh with the rifling in the bore of the weapon when the round is fired.

For the differences among artillery weapons by trajectories, see Figure 18. Mortar ammunition will be covered later in this subcourse.

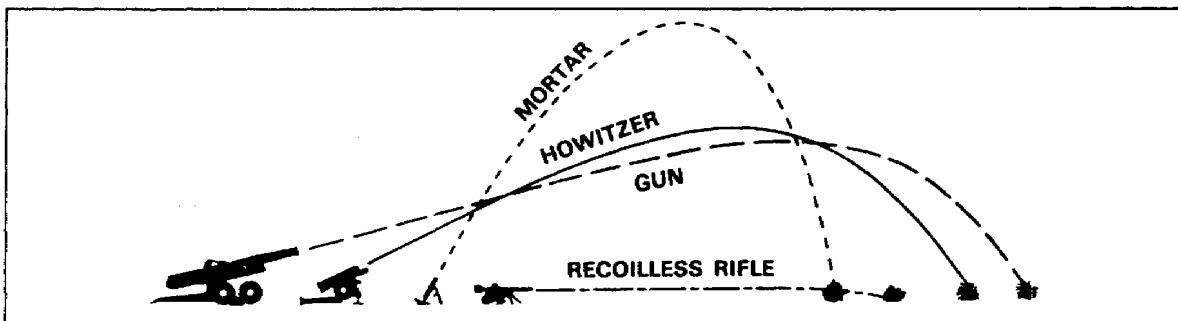


Figure 18. Comparison of Typical Trajectories of Artillery Weapons.

**Eyebolt Lifting Plugs.** Eyebolt lifting plugs are used in separate loading projectiles for easier handling and to provide a closure for the fuze well.

**Closing Plugs.** Closing plugs are used in fixed and semifixed ammunition as a closure for the fuze well.

**Perforated Cartridge Cases.** Perforated cartridge cases are used only with recoilless rifle ammunition.

### Artillery Ammunition Packing

Artillery ammunition is packed in several types of containers (Figure 19). Inner containers may be made of styrofoam or fiber. Outer containers may be made of wood or metal.

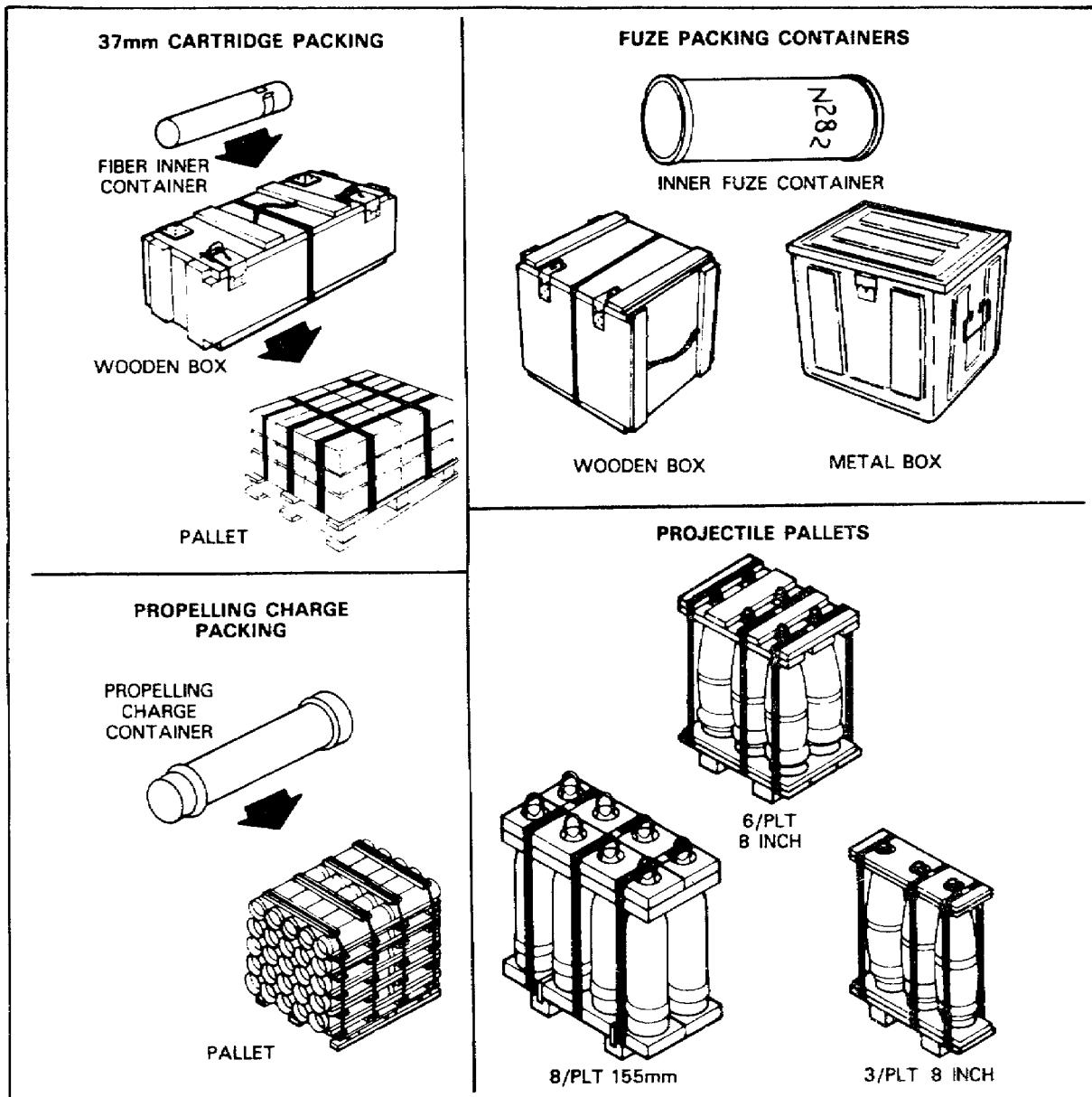


Figure 19. Typical Artillery Ammunition Packing.

The following are some points to remember about the packing of artillery ammunition: Fixed artillery ammunition is most commonly packed in cylindrical fiber containers, with more than one fiber container in a wooden box. Separate loading projectiles are issued individually or palletized. Propelling charges are issued individually or palletized. Fuze are normally issued in sealed individual containers in a wooden or metal box, but they may also be issued in metal containers with styrofoam packing. Primers will normally be included in the propelling charge container, but they may also be issued packed separately.

## IDENTIFYING MORTAR AMMUNITION

The mortar is a light-to medium-weight weapon designed to be disassembled for hand carrying. Fired from the ground or from a vehicle, it is a high-angle fire weapon, is muzzle-loaded, and may have a smooth or rifled bore.

Mortar ammunition is categorized as semifixed artillery ammunition, because the amount of propellant can be adjusted to obtain a desired range. Mortar ammunition is unique, however, in that the propellant is attached externally.

At this time, US forces use three sizes of mortar. They are the 60mm, the 81mm, and the 4.2-inch. The 60mm and 81mm are smooth-bore weapons; the ammunition is fin stabilized. The 4.2-inch mortar has a rifled bore; the ammunition is spin stabilized by a rotating disc. See Figure 20.

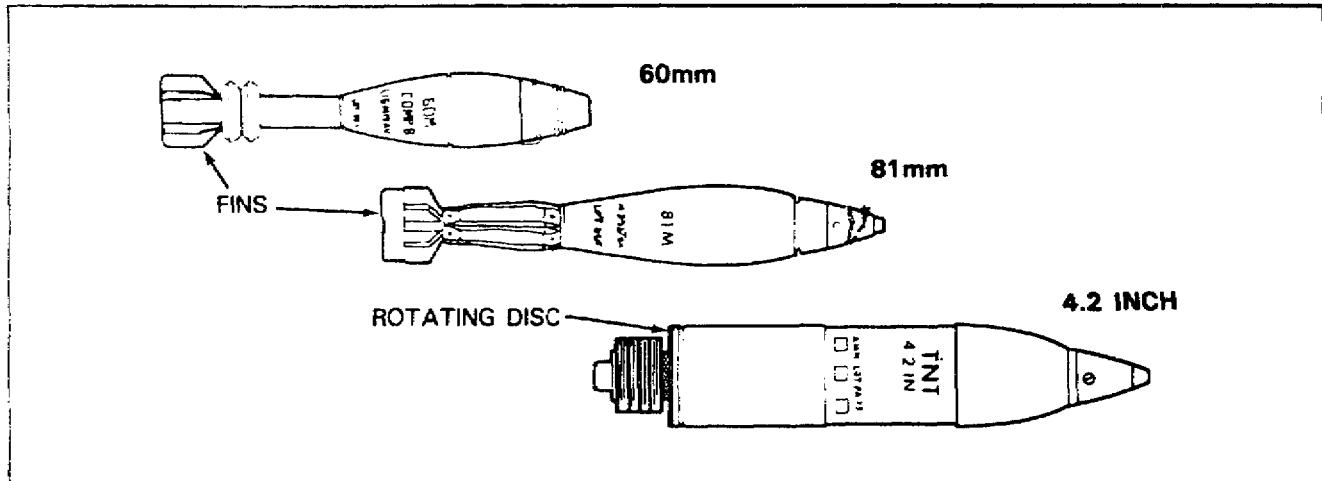


Figure 20. Typical Mortar Cartridges.

Mortar ammunition has several other unique identifying features. It has nose-mounted fuzes that may be point-detonating (PD), time, or proximity types; and it is equipped with ignition cartridges with percussion primers in the base and external propellant-increment charges mounted near the ignition cartridge.

### 60mm Mortar Ammunition

The smallest mortar round now found in US forces' stocks is 60mm. Types of 60mm cartridges include: high-explosive (HE), smoke-white phosphorous (SMK-WP), illuminating (ILLUM), target practice (TP), and training.

**60mm HE Mortar Ammunition.** Used to create blast and fragmentation against personnel and light material, 60mm HE mortar ammunition cartridges are olive drab with yellow markings. They come in two basic

configurations, the old type and the improved new type. Take a moment to familiarize yourself with these two cartridges and compare their features using Figure 21 and the chart below.

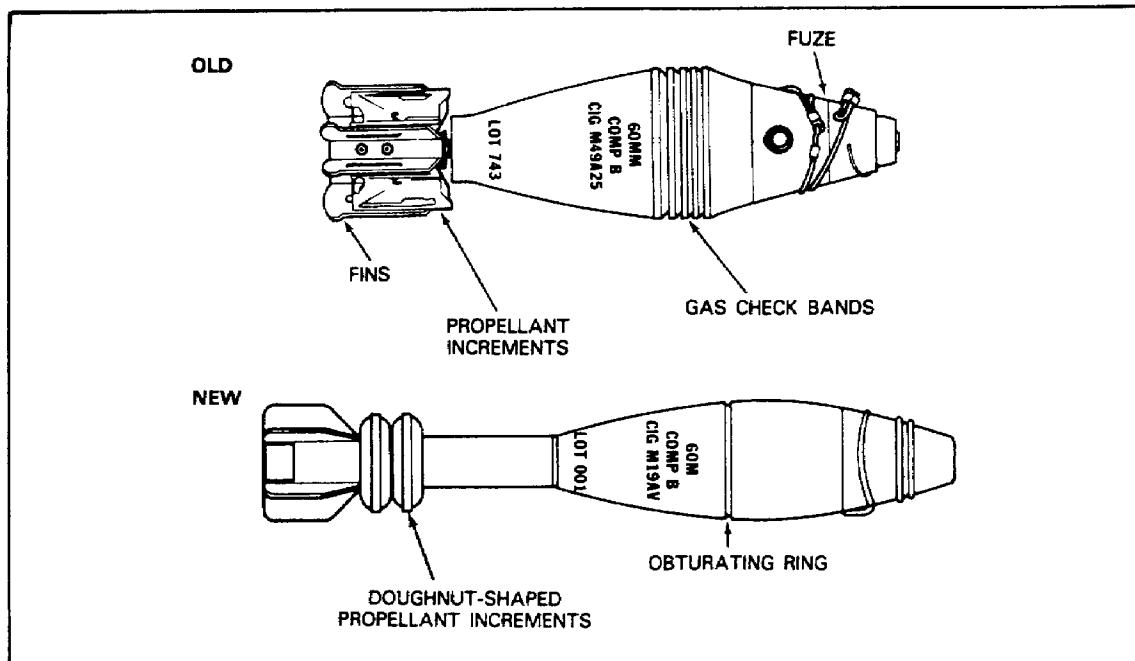


Figure 21. Old and New Types of 60mm HE Mortar Ammunition.

COMPARISON OF OLD AND NEW TYPES OF 60mm HE MORTAR CARTRIDGES		
FEATURES	OLD	NEW
Cartridge shape	Short, teardrop.	Longer, streamlined.
Propellant increments	Clamped between fins.	Sealed in plastic around fin assembly in front of fins. This kind of increment is often referred to as horseshoe shaped or doughnut shaped.
Gas sealing method	Canted (slanted on one side) grooves on largest part of body. These grooves are also called gas check bands.	Obturating ring on largest part of body.
Fuze	Nose-installed point-detonating.	Nose-installed point-detonating. May also be fitted with new multi-option fuze that may be set on impact, near-surface burst, or with proximity settings.

**60mm Smoke-White Phosphorous Mortar Ammunition.** The 60mm smoke-white phosphorous mortar cartridge, used primarily for smoke-screening and smoke-spotting, is shown in Figure 22. Note that the largest portion of its body is cylindrical. The fuze, fin assembly, gas check band, and propellant increments are the same as in the old type HE round shown in Figure 21. The round has a high-explosive burster charge extending through the white phosphorous filler. Upon impact, the point-detonating fuze functions, detonating the high-explosive burster. The body is then ruptured and the white phosphorous filler is scattered. The white phosphorous is ignited upon contact with the air, and it burns and produces smoke. This round may have one of two color codes, gray with yellow markings and a yellow band (old color code) or light-green with light-red markings and a yellow band (new color code).

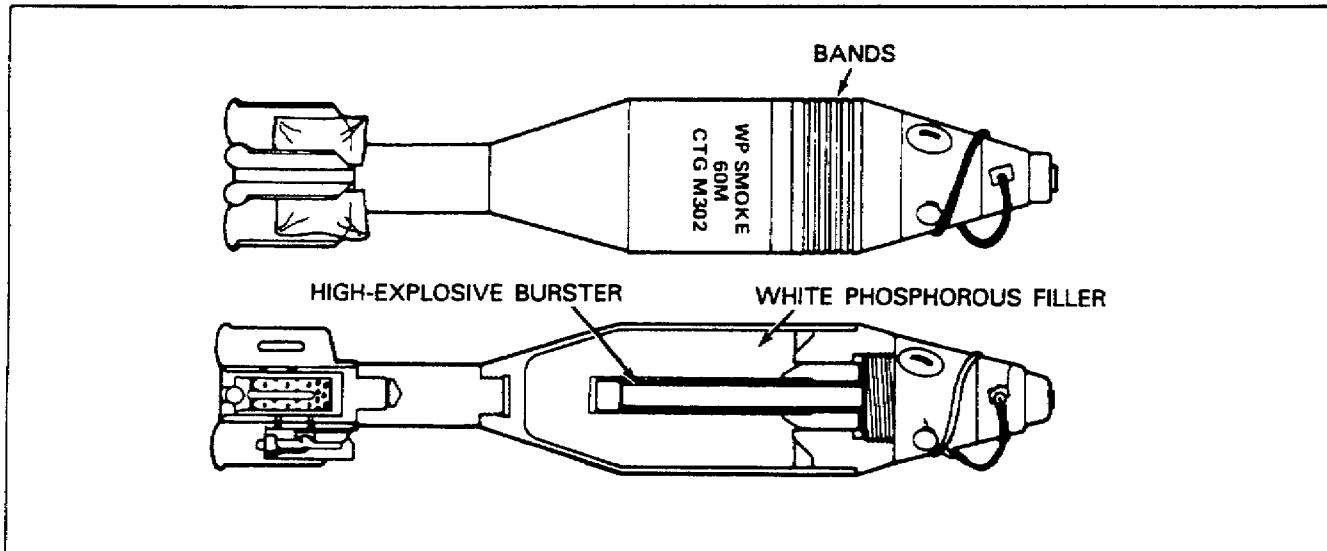


Figure 22. 60mm Smoke-White Phosphorous Mortar Cartridge.

**60mm Illuminating Mortar Ammunition.** The 60mm illuminating mortar cartridge is used to light night missions. The illuminating cartridge is shown in Figure 23. Note that the body has an elongated cylindrical shape and has no gas check band or obturating ring, the fuze is short and 60mm in diameter at its base, and the fin assembly and propellant increments are the same as in the old HE cartridge and the white phosphorous round. This round contains an expelling charge of low-explosive, an illuminating charge, and a parachute. The fuze functions 15 seconds after firing. It ignites the expelling charge, and expanding gases push the entire contents rearward. The pressure shears off the pins holding the fin assembly, and the illuminating charge is ignited. The illuminating charge is expelled, and the parachute opens. The burning illuminating charge provides light as it descends by parachute. The round is white with black markings.

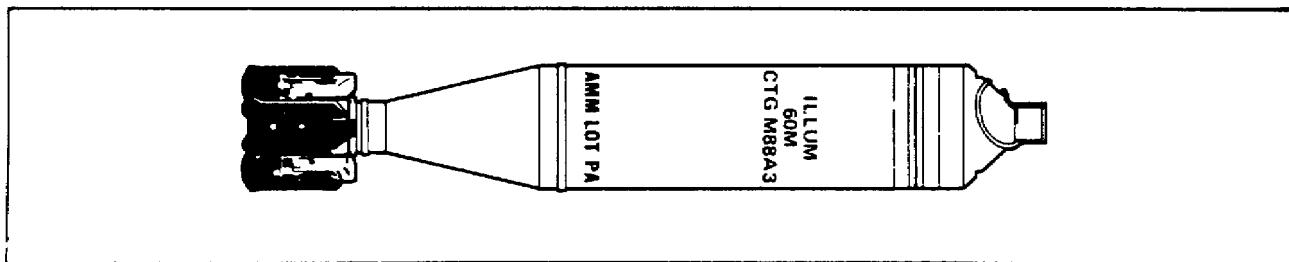


Figure 23. 60mm Illuminating Mortar Cartridge.

**60mm Target Practice Mortar Ammunition.** The 60mm target practice mortar cartridge is used to provide realistic training without causing damage or using ammunition reserved for combat. The old 60mm target practice round (Figure 24) is identical in shape to the old type HE round, but the target practice round has a small black powder spotting charge and an inert plaster filler to make the weight correct. The target practice round uses a point-detonating fuze that functions upon impact, igniting the spotting charge. The spotting charge produces a small puff of smoke to mark the impact point. The only external difference between the old HE and the old target practice round is the color code. The old target practice round is blue with white markings and a brown band. The letters "BP" on the body stand for black powder. The new 60mm target practice mortar cartridge (Figure 25) contains a subcaliber device that can be fired in the same manner as standard service mortar ammunition, using standard mortar sighting and fire-control equipment and a special firing table.

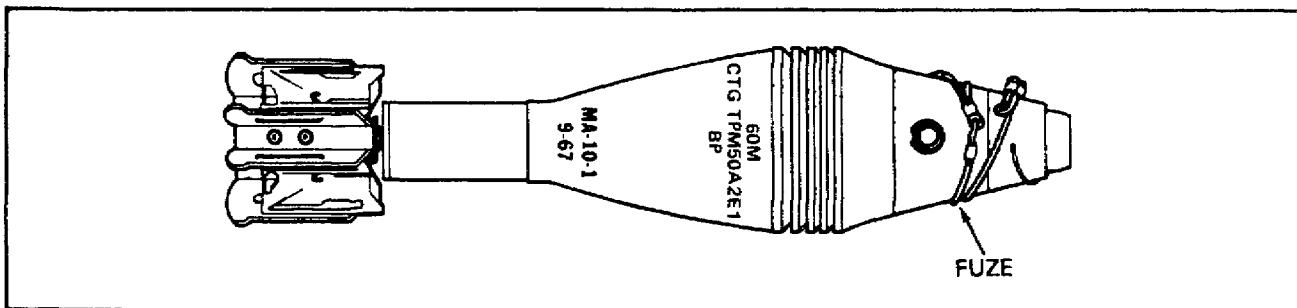


Figure 24. 60mm Target Practice Mortar Cartridge (Old).

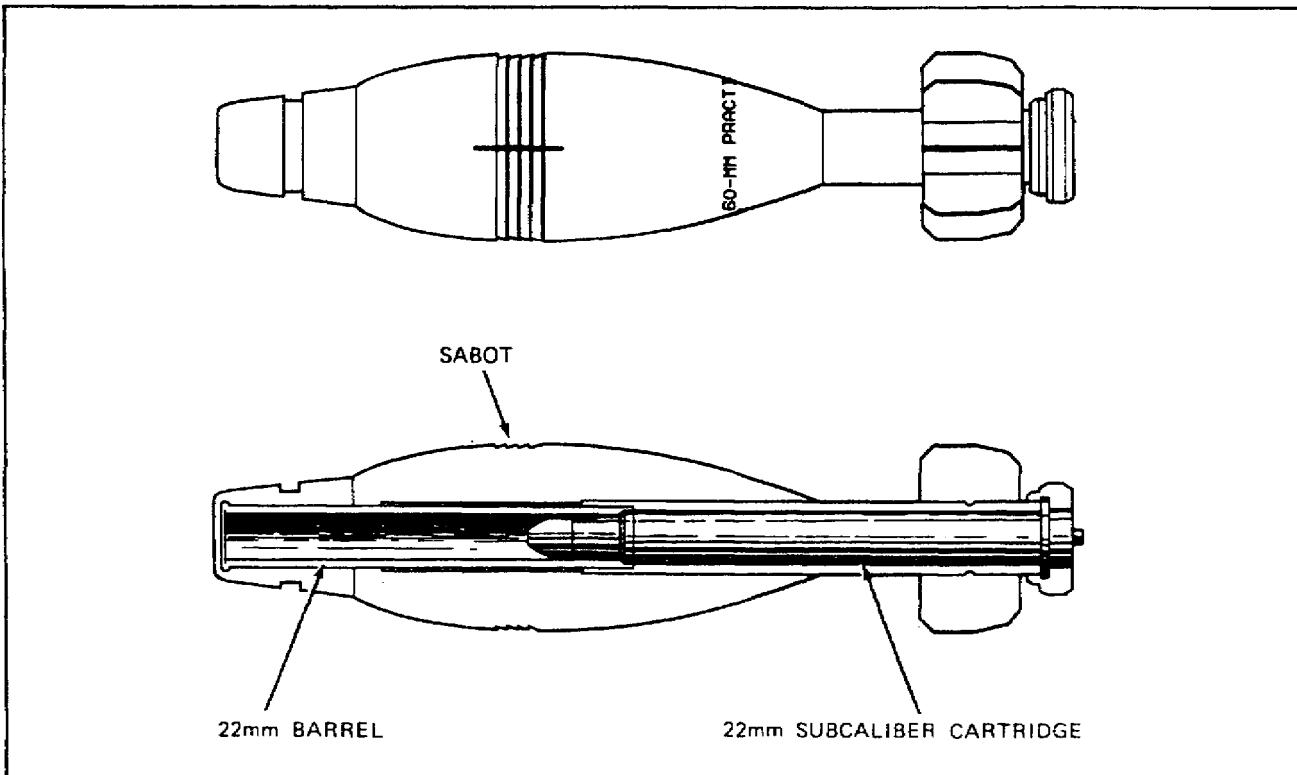


Figure 25. 60mm Target Practice Mortar Cartridge (New).

**60mm Training Mortar Ammunition.** The 60mm training mortar cartridge is used to train personnel in loading and firing the mortar. The round is completely inert except for an ignition cartridge, and it is propelled using the ignition cartridge charge only. After firing, the round is recovered and fitted with a new ignition cartridge so it can be fired again. See Figure 26. This round is easily identified by its pear shape and the absence of propellant increments. Old rounds are black or blue with white markings, and new rounds are bronze with white markings.

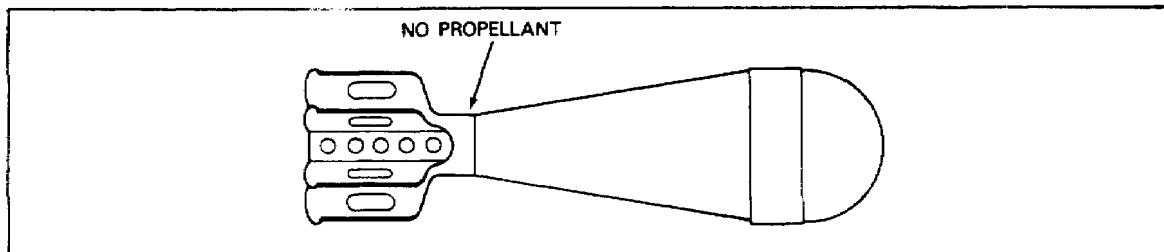


Figure 26. 60mm Training Mortar Cartridge.

### 81mm Mortar Ammunition

The 81mm is the most widely used mortar round in the US Army. Types of 81mm cartridge include: high-explosive (HE), smoke-white phosphorous (SMK-WP), illuminating (ILLUM), target practice (TP), training, and countermeasure (leaflet and chaff).

**81mm HE Mortar Ammunition.** The 81mm HE mortar cartridge is found in two basic shapes, as shown in Figure 27. The cartridge at the top in the illustration is an old type HE round that is obsolete but may still be

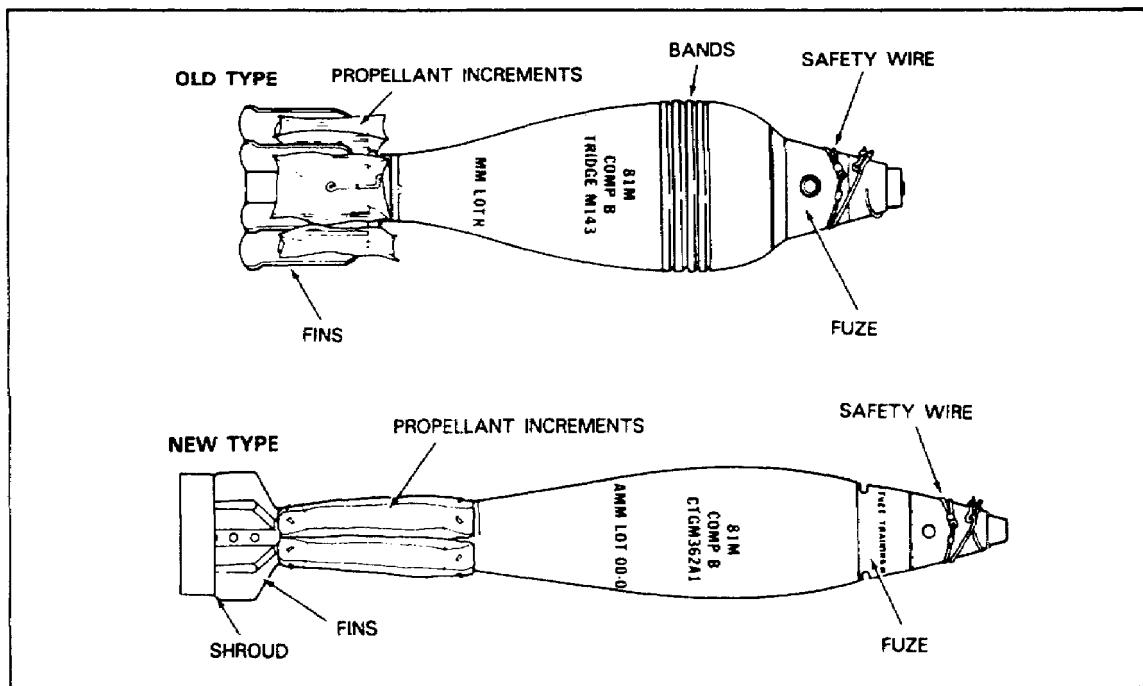


Figure 27. 81mm HE Mortar Cartridges.

found in some stocks. It is similar in shape to the old type 60mm HE mortar cartridge. The difference is in size. The 81mm HE is 81mm in diameter at its largest point (approximately 3.8 inches). The cartridge at the bottom in the illustration is the new type HE round. It has a longer, streamlined shape. It has propellant increments in cloth bags on the fin assembly in front of the fins. It does not have a gas check band.

The new type 81mm HE mortar cartridge has been improved further. On various models, obturating rings, horseshoe shaped or doughnut-shaped propellant increments covered by a plastic cover, or fin assemblies with a shroud have been added. The colors on the 81mm HE mortar cartridge are the same as on other HE ammunition, olive drab with yellow markings. (See Figure 21 and the chart on page 21 for comparable improvements on 60mm HE mortar ammunition.)

**81mm Smoke-White Phosphorous Mortar Ammunition.** The 81mm smoke-white phosphorous mortar cartridge is found in two configurations, as shown in Figure 28. The cartridge at the top is no longer manufactured but may still be found in storage. It is an elongated cylindrical round with a gas check band between the fin assembly and the projectile body. This type is often still painted in the old color code, gray with yellow markings and a yellow band. The bottom cartridge in Figure 28 is the latest model of the 81mm smoke-white phosphorous mortar cartridge. It has an improved, streamlined shape and an obturating ring. There are other models that have no obturating ring, have fewer propellant increments, or have a fin shroud. All of the new type are painted in the new color code, which is light-green with light-red markings and a yellow band.

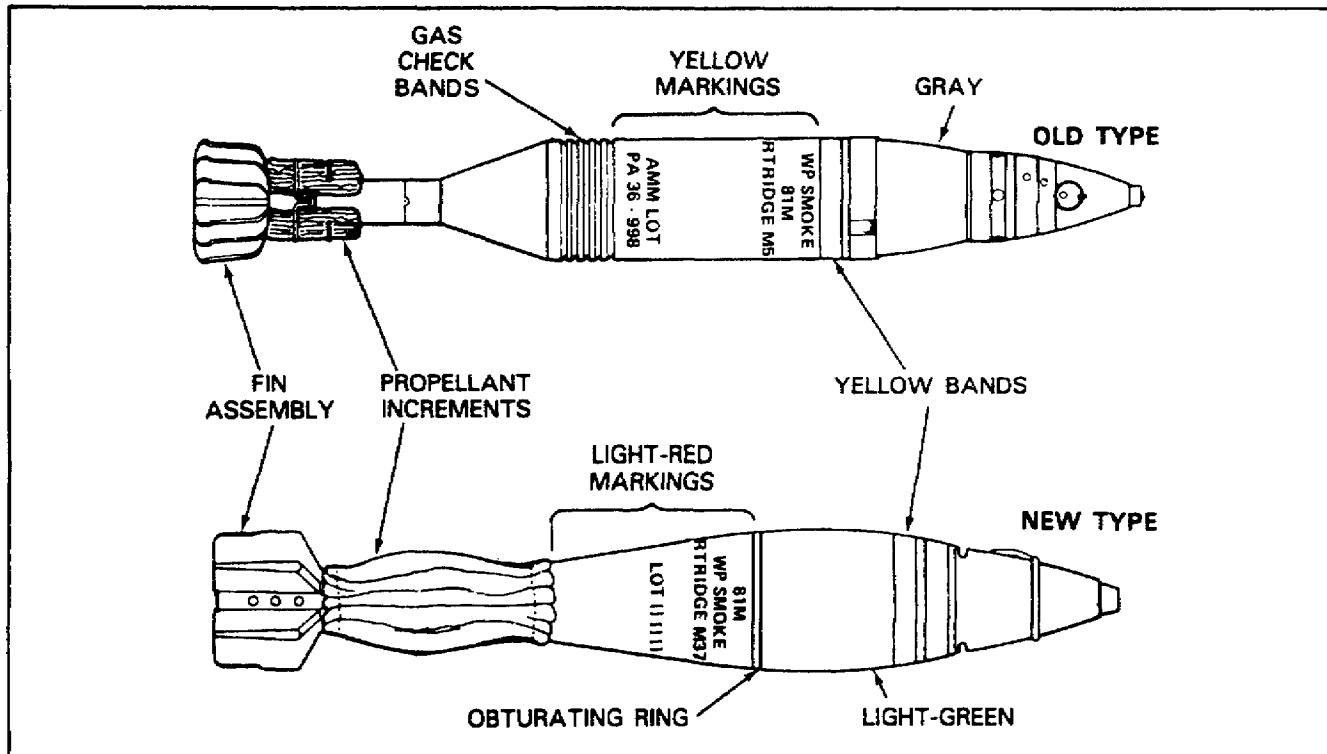


Figure 28. 81mm Smoke-White Phosphorous Mortar Cartridges.

**81mm Illuminating Mortar Ammunition.** The 81mm illuminating mortar cartridge is used for night illumination of a desired area. See Figure 29. This cartridge is sometimes confused with the old type 81mm smoke-white phosphorous cartridge (see Figure 28) because it has the same type of fin assembly and propellant

increments. The illuminating round, however is fitted with a time fuze, has a base of larger diameter, and has no gas check bands. The 81mm illuminating mortar cartridge is painted in two color codes. Old cartridges may be gray with white markings and a white band. Most rounds now in stock have the new color code, white with black markings.

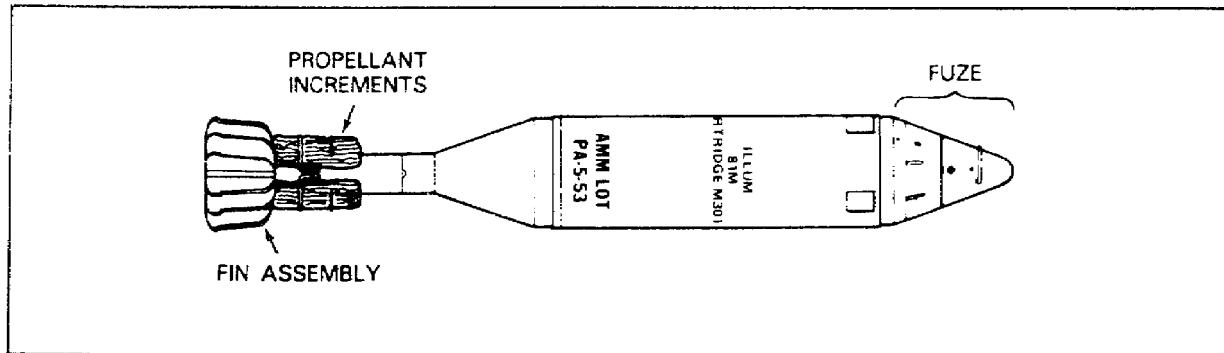


Figure 29. 81mm Illuminating Mortar Cartridge.

**81mm Target Practice and Training Mortar Ammunition.** The 81mm target practice mortar cartridge (Figure 30) is designed to fire a 22mm subcaliber practice cartridge M744, M745, M746, or M747 in any 81mm mortar. It provides realistic mortar firing practice at distances that correspond to range firing. The subcaliber

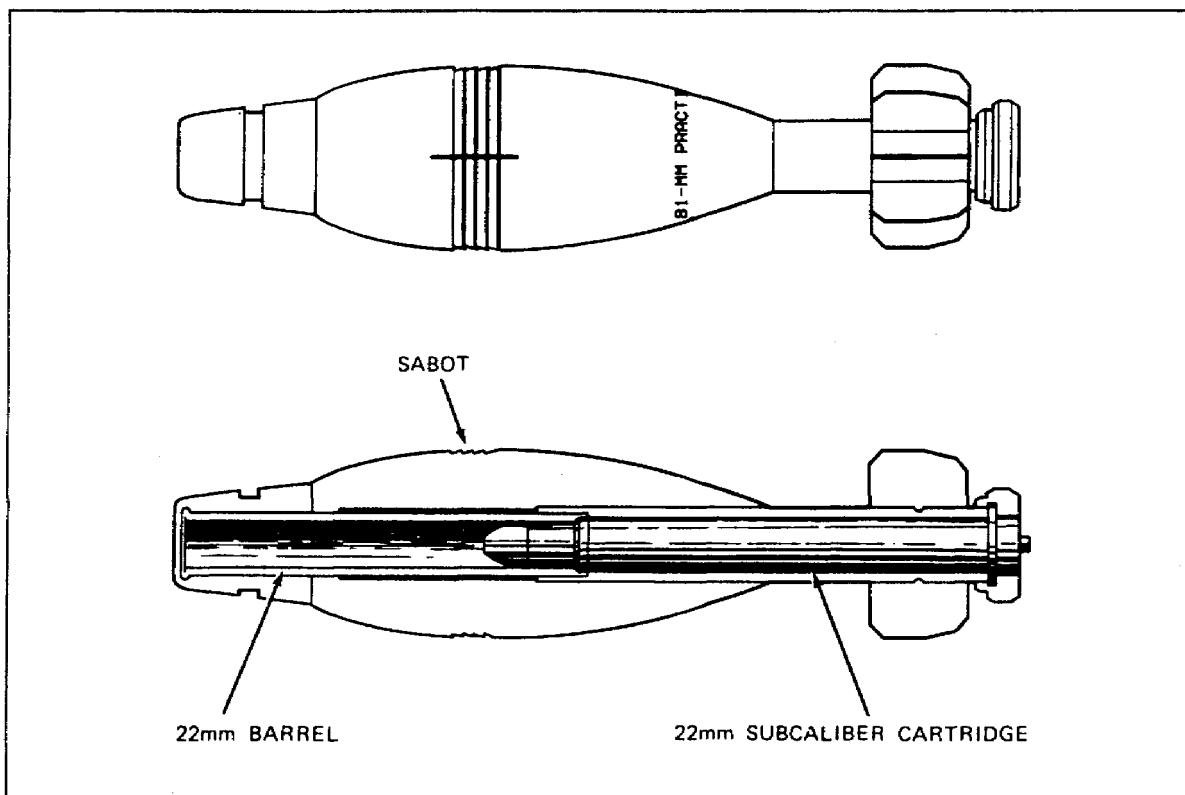


Figure 30. 81mm Target Practice Mortar Cartridge.

device can be fired in the same manner as standard service mortar ammunition, using standard mortar sighting and fire-control equipment and a special firing table.

The 81mm training mortar cartridge is found in two configurations. See Figure 31. The cartridge at the top has the shape, size, and weight of the newer, streamlined cartridges. It has a dummy fuze. Both have inert fillers and live ignition cartridges; they have no propellant increments. Newer cartridges may use a small, replaceable, smoke spotting charge. Both cartridges are found in two different color codes. Old rounds are black with white markings, and newer rounds are bronze with white markings.

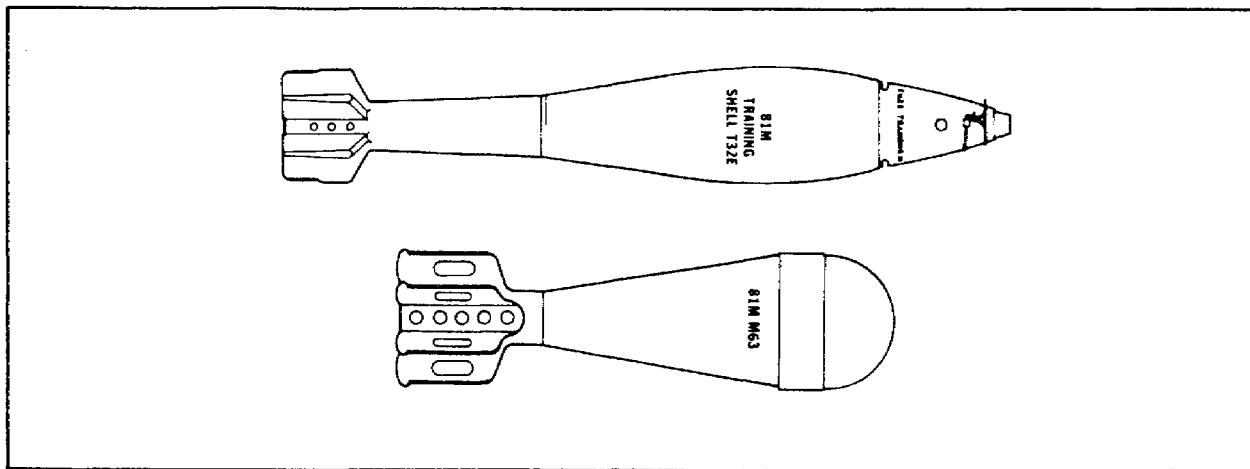


Figure 31. 81mm Training Mortar Cartridges.

#### 4.2-Inch (107mm) Mortar Ammunition

The 4.2-inch round is the largest mortar cartridge used by US forces. It is unique in that it is spin-stabilized in flight. The 60mm and 81mm mortar cartridges are fin-stabilized in flight. There are five types of 4.2-inch mortar cartridges: high-explosive (HE), smoke-white phosphorous (SMK-WP), toxic chemical (gas), tactical CS (CSTAC) (tear gas), and illuminating (ILLUM). There are no practice or training 4.2-inch mortar cartridges. Practice and training for the 4.2-inch crew are accomplished by inserting a smaller tube inside the bore and using 60mm practice and training cartridges.

**4.2-Inch HE Mortar Ammunition.** The 4.2-inch HE mortar cartridge is used to create blast and fragmentation against personnel and material. It is produced in two basic configurations. See Figure 32. The cartridge on the left is the most common. It has a rotating disc at the base that expands upon firing and engages the lands and grooves. This causes the round to spin when it is forced through the bore. The spin continues in flight. The cartridge on the right has no rotating disc. It has a rotating band that is pre-engraved to fit the lands and grooves, and an obturator made of a rubberized material immediately behind the rotating band. The obturator expands and seals gases when the round is fired. Both cartridges use basically the same type of ignition cartridge. Examine the two types of 4.2-inch mortar tail assemblies in Figure 32. All 4.2-inch HE mortar cartridges are painted in the standard color code for HE, olive drab with yellow markings.

**4.2-Inch Smoke-White Phosphorous Mortar Ammunition.** The 4.2-inch smoke-white phosphorous mortar cartridge is used as an incendiary device against personnel and material and to produce a screening smoke. See Figure 33. The two cartridges shown differ only in the tail assembly, the fuze, and the color code. The old cartridge may be gray with yellow markings and a yellow band. The new cartridge, an improved model, is always painted in the new color code, light-green with light-red markings and a yellow band.

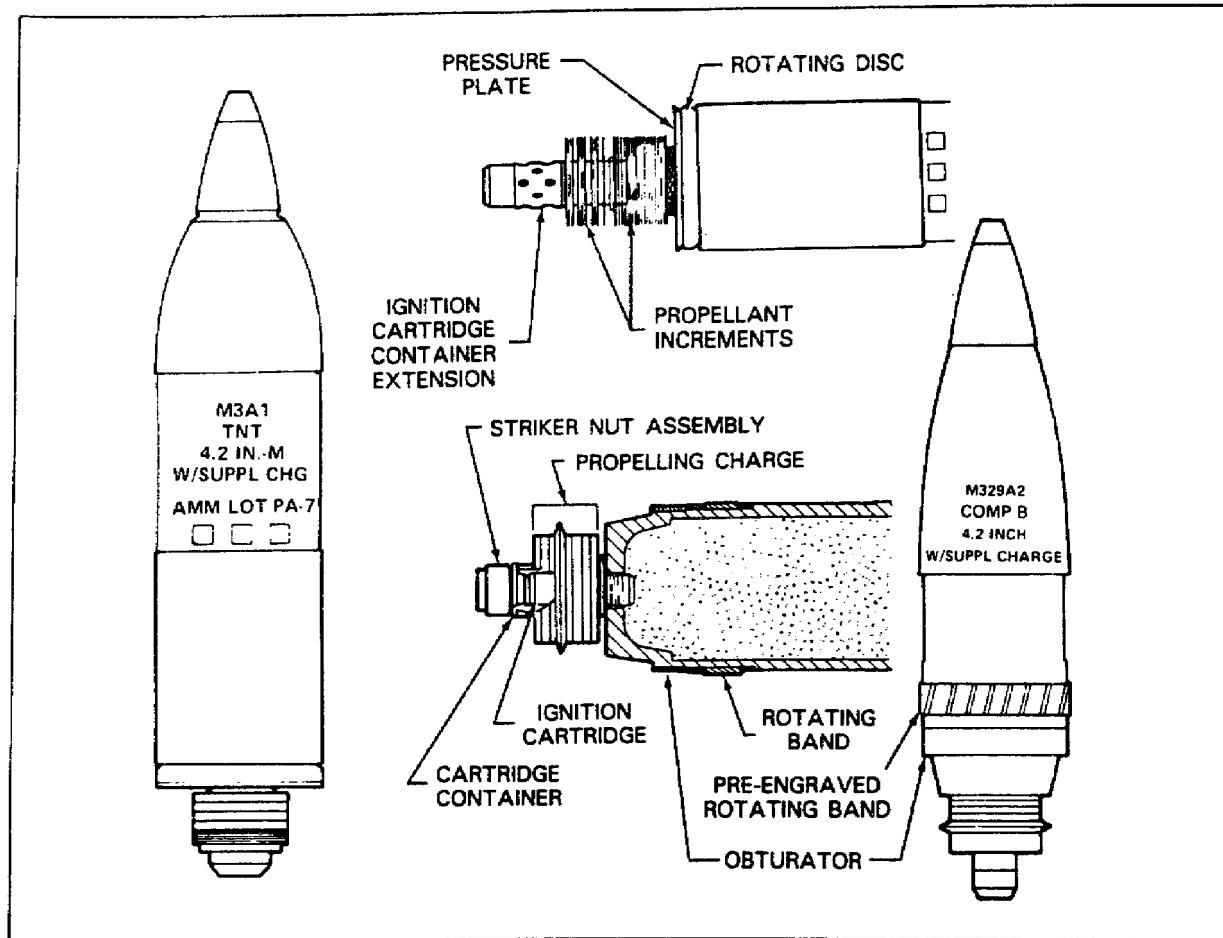


Figure 32. 4.2-Inch HE Mortar Cartridges.

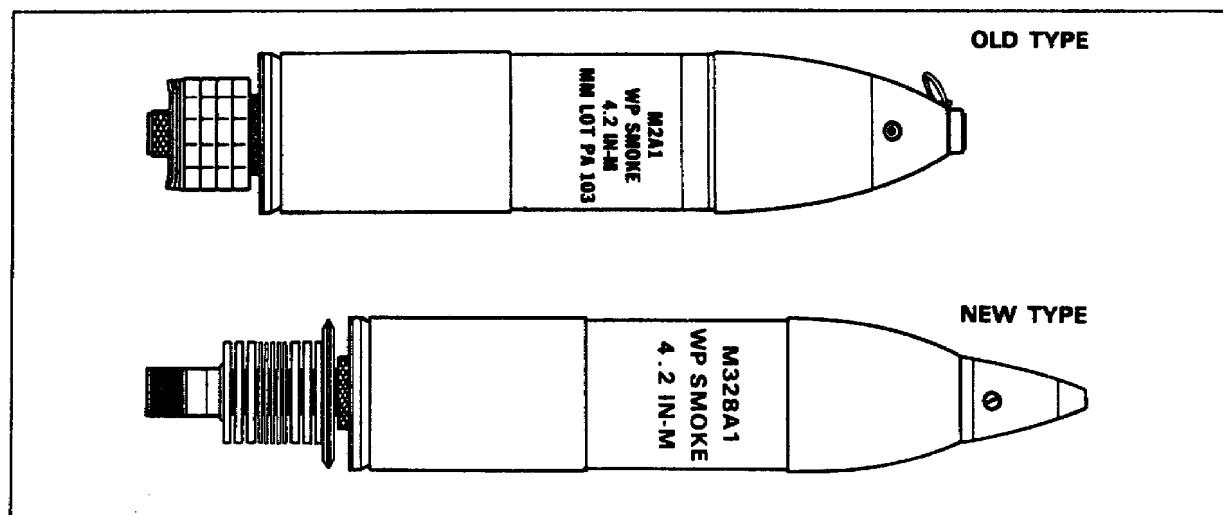


Figure 33. 4.2-Inch Smoke-White Phosphorous Mortar Cartridges.

**4.2-Inch Chemical Mortar Ammunition.** There are two types of 4.2-inch cartridges designed specifically to disperse a toxic or irritant chemical agent. See Figure 34. The 4.2-inch gas cartridge is filled with a toxic chemical agent, has a high-explosive burster similar to the smoke-white phosphorous cartridge, and has a point-detonating fuze. It functions on impact; the burster detonates, rupturing the projectile body and dispersing the chemical agent. This cartridge has a color code of gray with a dark-green band and dark-green markings. The 4.2-inch tactical CS (CS-TAC) cartridge is filled with four separate canisters containing a flammable CS (tear gas) mixture. It uses a time fuze that functions at a predesignated time after firing. The fuze ignites a black-powder expelling charge that ignites and expels the CS canisters from the base. This cartridge is color-coded gray with a dark-red band and dark-red markings.

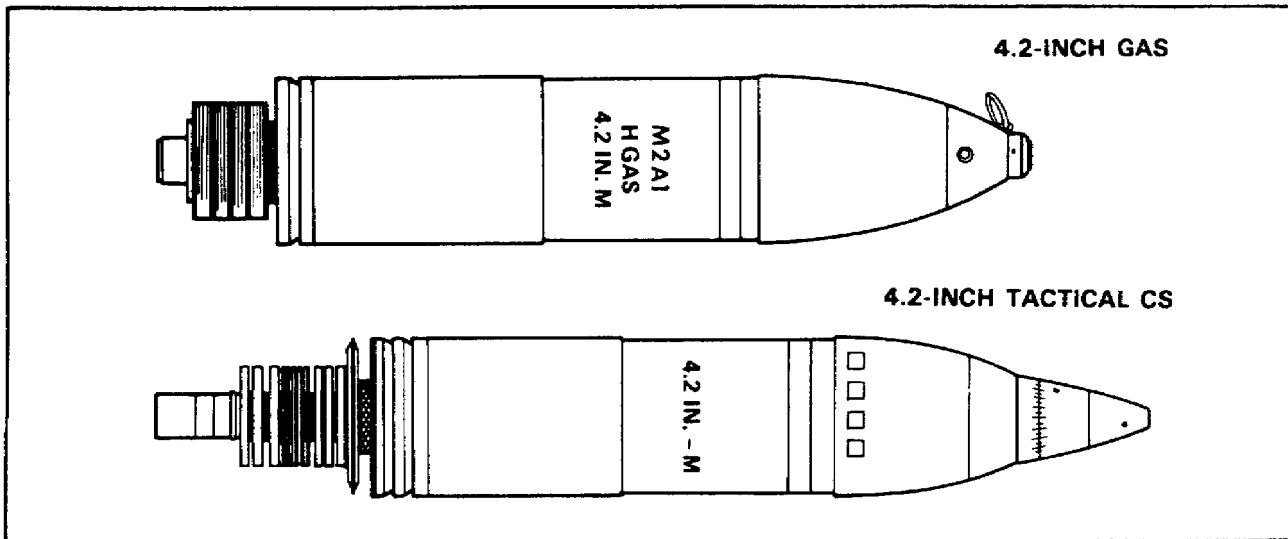


Figure 34. 4.2-Inch Chemical Mortar Cartridges.

**4.2-Inch Illuminating Mortar Ammunition.** The 4.2-inch illuminating mortar cartridge is shown in Figure 35. This cartridge uses a time fuze and a black-powder expelling charge. The filler consists of illuminating charges and a parachute. When the fuze functions at a pre-designed time after firing, the entire payload is expelled from the base. The illuminating charge is ignited, and the parachute opens. The burning illuminating charge provides light as it descends by parachute.

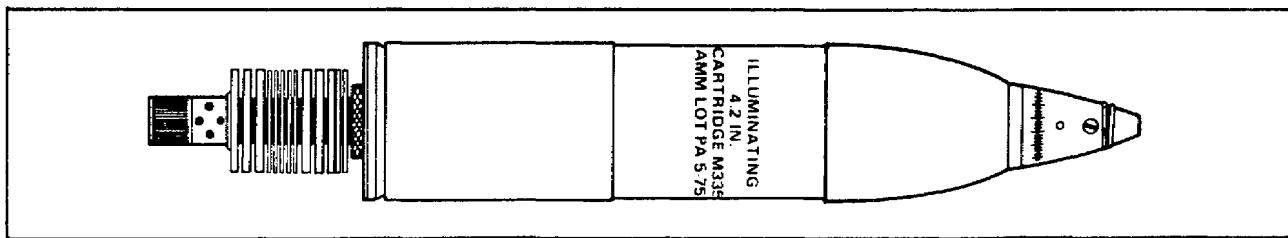


Figure 35. 4.2-Inch Illuminating Mortar Cartridge.

### Mortar Ammunition Packing

All mortar ammunition is packed one cartridge to a cylindrical fiber container, with from 2 to 12 fiber containers in a wooden box, depending on the caliber. See the 37mm cartridge packing examples in Figure 19.

## IDENTIFYING ROCKET AMMUNITION

A military rocket is a projectile propelled by a discharging jet of gas produced by burning a propelling charge within the rocket. A rocket, therefore, may be defined as a self-propelled projectile. Although rockets are often confused with guided missiles, they are not the same. Rockets and guided missiles are propelled in the same manner, but a rocket cannot be controlled in flight like a guided missile.

The components of a military rocket (see Figure 36) consist essentially of the warhead, the fuze, the motor, and the fin assembly. The warhead is the portion of the rocket that produces the desired effect. The fuze is the component that initiates the desired effect at the desired time. The motor is what propels the rocket to the target. The motor consists of the propelling charge, the igniter, and the nozzle assembly. The fin assembly acts as a stabilizer. A rocket can be stabilized by spin, by fins, or by a combination of both spin and fins. All rockets now in US stocks are fin-stabilized or use a combination of fin and spin stabilization.

A rocket launcher is a device used to aim the rocket and provide a means for igniting the rocket motor. Some launchers are expendable and are discarded after one firing. These launchers also serve as shipping containers.

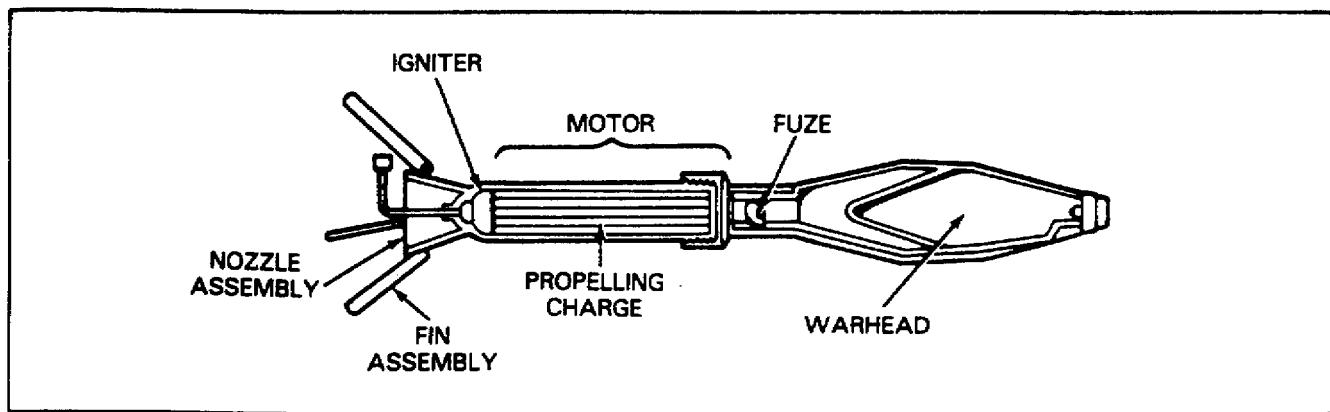


Figure 36. Components of Rockets.

### Classification of Rocket Ammunition

Rockets are generally classified as shoulder-fired, ground-to-ground, or aircraft. Aircraft rockets may be further classified as air-to-air or air-to-ground. Rockets are also classified by use and by filler.

**By Use.** Rockets are classified by use as follows: service (combat), practice (training and target practice), drill (training in handling), and subcaliber (small rockets designed for practice as a cheaper means of training).

**By Filler.** Like the ammunition previously studied, rockets are classified by filler (which also designate the primary purpose).

*Antipersonnel.* Contains flechettes. Used against personnel and light material.

*High-Explosive.* Contains a filler for blast fragmentation, mining, or demolition.

*High-Explosive Antitank.* Contains a shaped charge for penetration of armored targets.

*Chemical.* Contains a chemical agent and a high-explosive burster to disperse the chemical agent.

*Smoke.* Contains a filler of white phosphorous or another smoke mixture used to produce screening and signaling smoke. Generally, smoke rockets are also considered to be chemical.

*Practice.* Contains no filler except for small spotting charges. Practice rockets use the same rocket motors as service rockets.

*Drill.* Is completely inert, both warhead and motor. Used for training.

### Types of Rockets

The most common types of rockets now in US stocks include the following: the 66mm light antitank weapon (LAW); the 66mm incendiary rocket, M74; the 66mm riot-control rocket, M96; and the 2.75-inch rocket.

**66mm Light Antitank Weapon.** The 66mm light antitank weapon, commonly known as the LAW system, consists of a HEAT rocket packaged in a container that is also the launcher. See Figure 37. The launcher is made of fiberglass and aluminum. The rocket is sealed inside the launcher. (Figure 37 shows the launcher and rocket separated for the sake of exposition, but the rocket can not actually be removed from the launcher.) The assembly is about 26 inches long and extends telescopically to about 35 inches before firing. The rocket is 66mm in diameter and about 20 inches long.

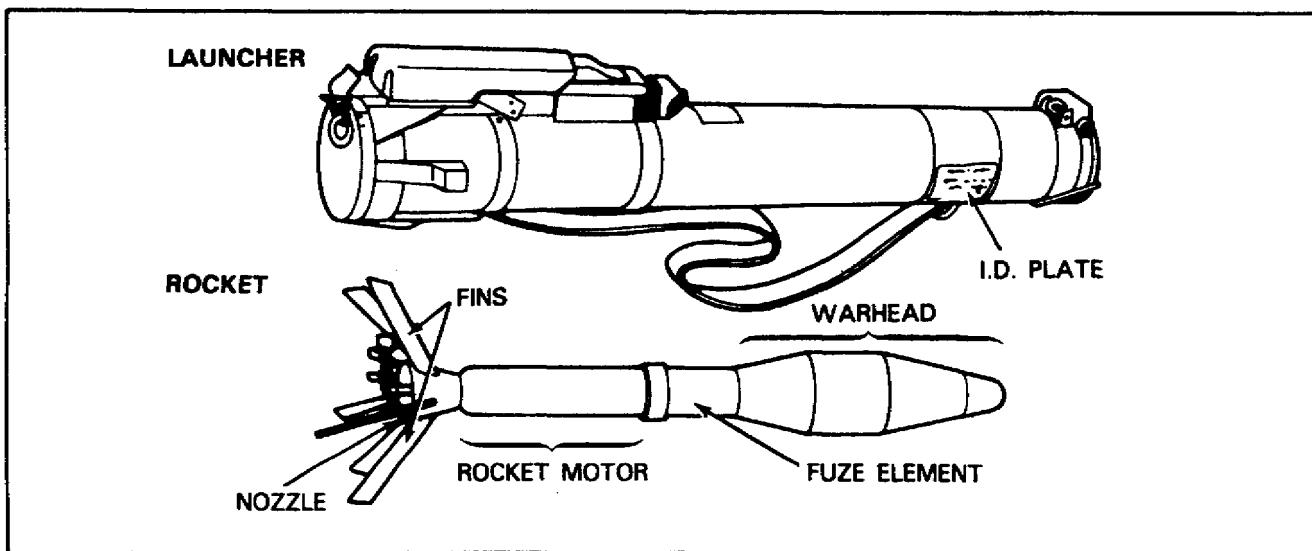


Figure 37. 66mm LAW System.

The rocket has a high-explosive antitank (HEAT) warhead and a point-initiating, base-detonating (PIBD) fuze. It has a rocket motor with 19 sticks of propellant, a percussion-fired igniter, a single nozzle, and six folding fins. The rocket motor is ignited by a small percussion primer connected by a flash tube to the igniter element. The motor has one cone-shaped nozzle and six folding fins. The fins are held in the extended position by springs when the rocket leaves the launcher after firing.

Because the 66mm LAW can be fired only once, using it in training would be very expensive. For training, therefore, a small subcaliber rocket is fired from an expended launcher that has been modified by installing a smaller tube inside. The subcaliber rocket has six fixed fins on the back end and three centering guide pins on the front end. It has a small rocket motor with a percussion igniter and a warhead containing a primer and a small flash charge. The entire rocket is about 9 inches long and 35 millimeters (1.37 inches) in diameter. See figure 38.

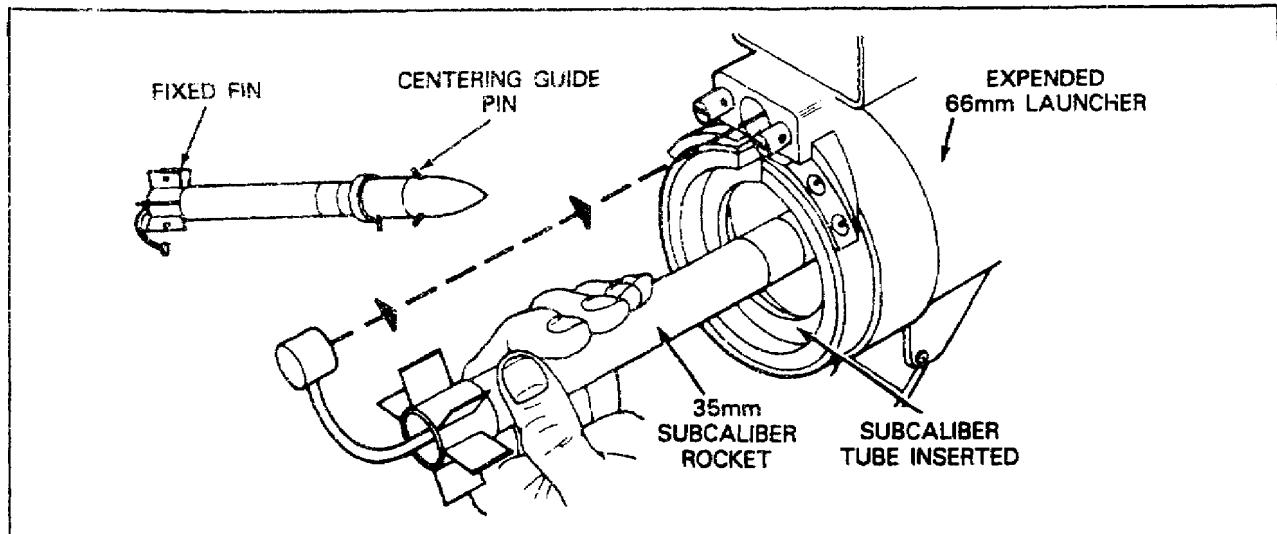


Figure 38. 35mm Subcaliber Rocket.

The LAW system is packed five rocket-filled launchers to a cardboard box, which is then sealed in a plastic barrier bag. Three of these are packed in each wooden box, for a total of 15 rockets. See Figure 39.

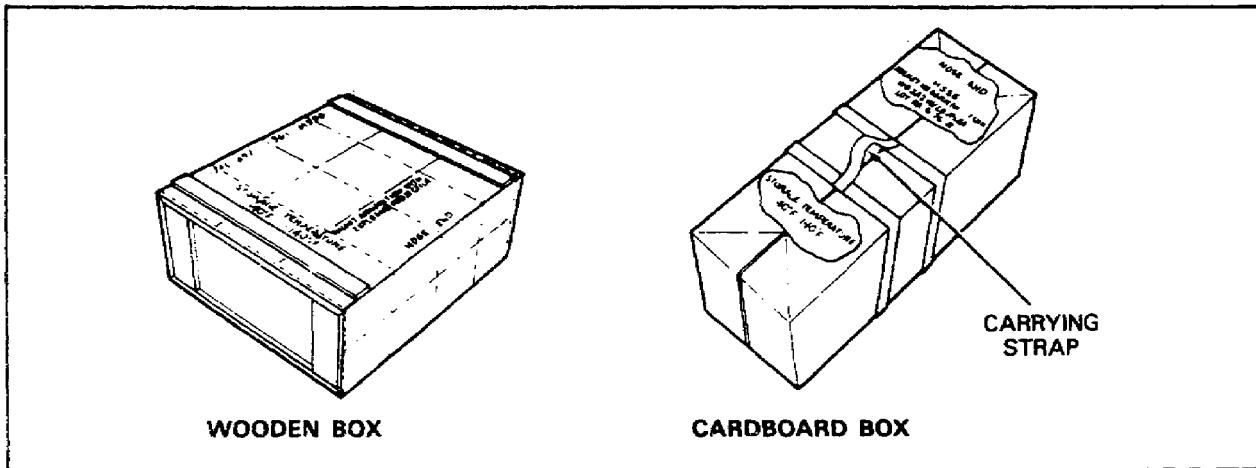


Figure 39. 66mm LAW System Packing.

**66mm Incendiary Rocket, M74.** The 66mm incendiary rocket is used against combustible targets. The complete system consists of a four-tube reusable launcher and four rockets in a four-round clip. See Figure 40.

The M74 incendiary rocket (Figure 41) consists of a warhead containing an incendiary mixture (called TPA), an HE burster charge, and a base-detonating fuze. The rocket motor is the same as that used with the 66mm HEAT (LAW) rocket. It has a percussion igniter, a nozzle, and six folding fins. It is color coded light-red to show that it is incendiary. It has a yellow band to show that it has an HE burster. The motor is brown, meaning low-explosive.

The 66mm incendiary rocket, M74, is packed in four-round clips, and each clip is packed in a styrofoam container. A backframe pack has been designed to carry two of these containers. See Figure 42. The launcher is issued separately.

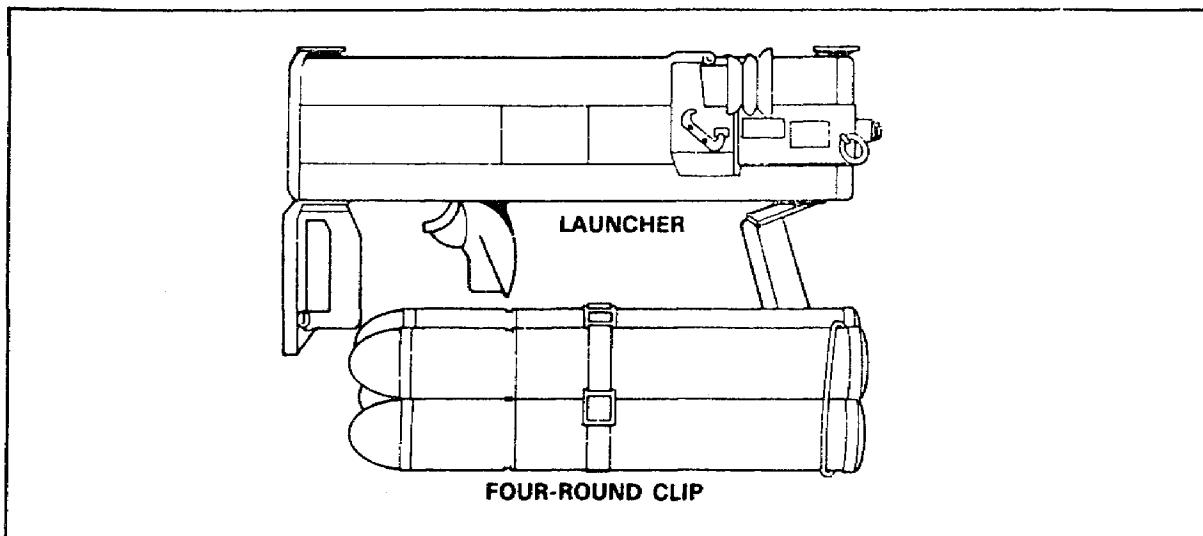


Figure 40. 66mm Incendiary Rocket System.

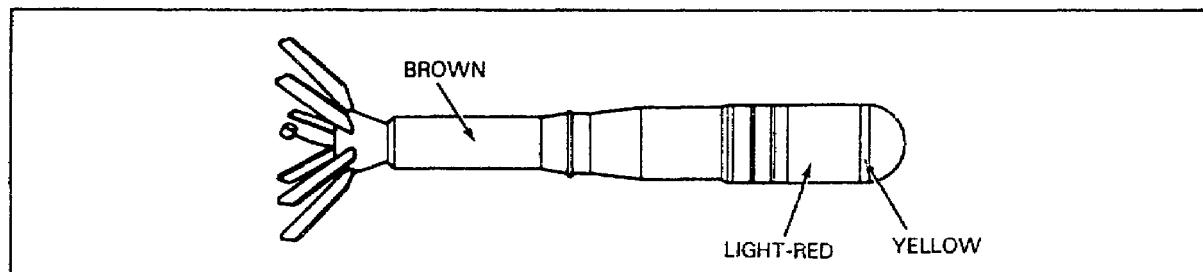


Figure 41. 66mm Incendiary Rocket, M74.

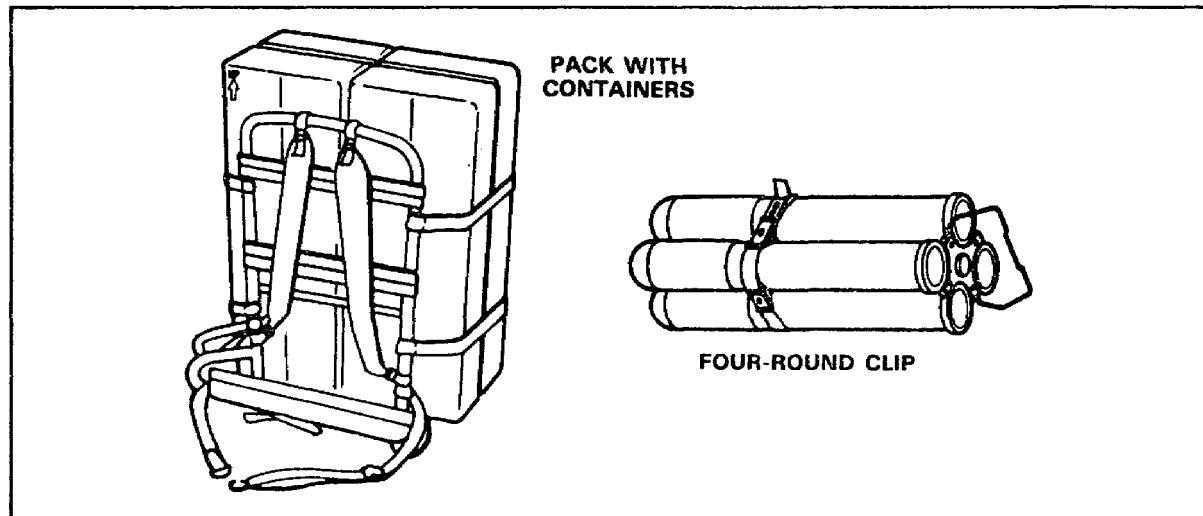


Figure 42. 66mm Incendiary Rocket System Packing.

**66mm Riot-Control Rocket, M96.** The 66mm riot-control rocket, M96 is identical to the M74 incendiary rocket except for its filler and color code. See Figure 43. The riot-control rocket, M96 is filled with a CS mixture (tear gas) and has an HE burster. It is packed the same way as the 66mm incendiary rocket, M74.

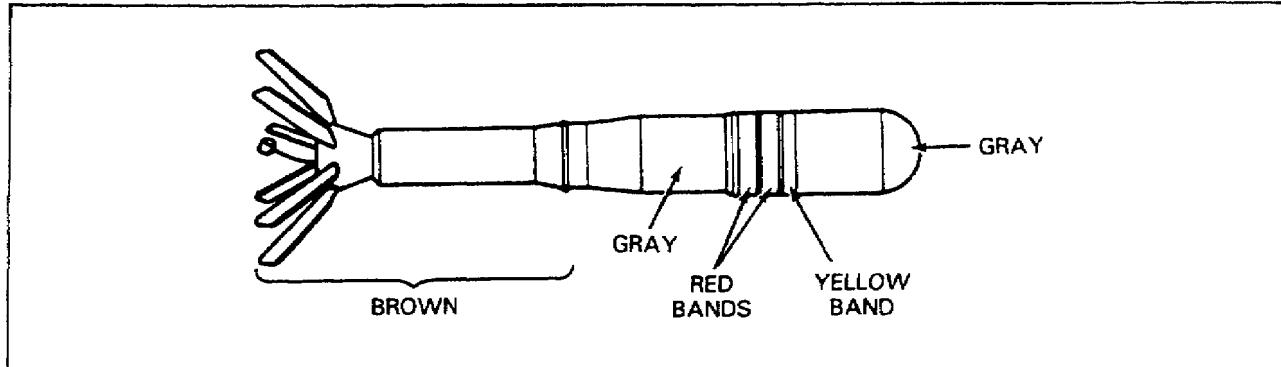


Figure 43. 66mm Riot-Control Rocket, M96.

**2.75-Inch Aircraft Rocket.** The 2.75-inch low-spin, folding-fin aircraft rocket (LSFFAR)(Figure 44) is an air-to-ground rocket fired from helicopters or other low-speed aircraft.

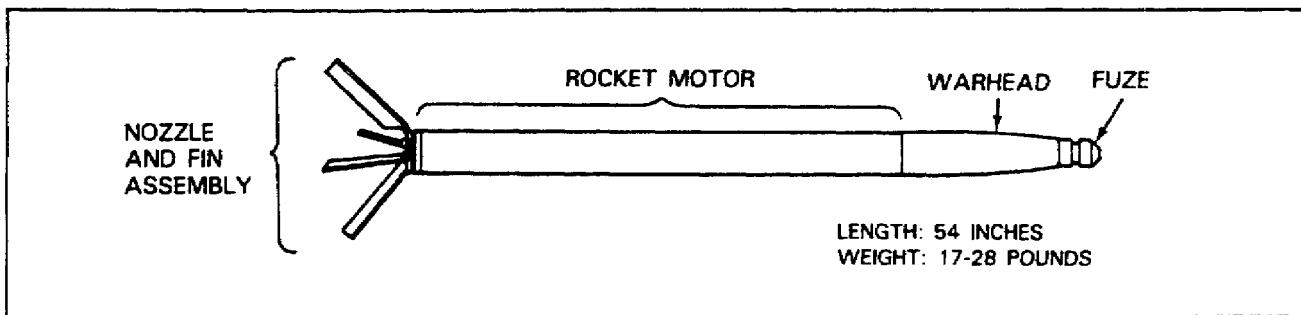


Figure 44. Typical 2.75-Inch Aircraft Rocket.

**Fuzes.** The 2.75-inch aircraft rocket uses a variety of fuzes, including: point-detonating (PD) fuzes; proximity (PROX) or variable time (VT) fuzes; point-initiating, base-detonating (PIBD) fuzes; and electronic time (ET) fuzes. The electronic time fuze has an umbilical connector that connects the fuze to the aircraft electrically and enables the pilot to select the time that the fuze will function from a control panel in the cockpit. Most 2.75-inch aircraft rocket fuzes are nose mounted, depending on the type of warhead used; but some warheads have fuzes installed in the base. The antipersonnel flechette warhead, for example, uses a fuze installed in the base. This makes the fuze an integral part of the warhead. Note how the fuzes are installed in the warheads in Figure 45.

**Warheads.** The 2.75-inch aircraft rocket also uses a variety of warheads, including, among others: high-explosive (HE) in two lengths, 13 inches and 23 inches; high-explosive antitank (HEAT); antipersonnel (apers) flechette; smoke-white phosphorous (SMK-WP); smoke screen; illuminating; and practice (has no spotting charge). There are several other types of warheads in various stages of development and distribution. Many contain small submunitions that are ejected from the warhead while the rocket is in flight. An example of this is the M261 multipurpose submunition (MPSM) warhead (Figure 46), the latest development in the HYDRA-70 rocket system.

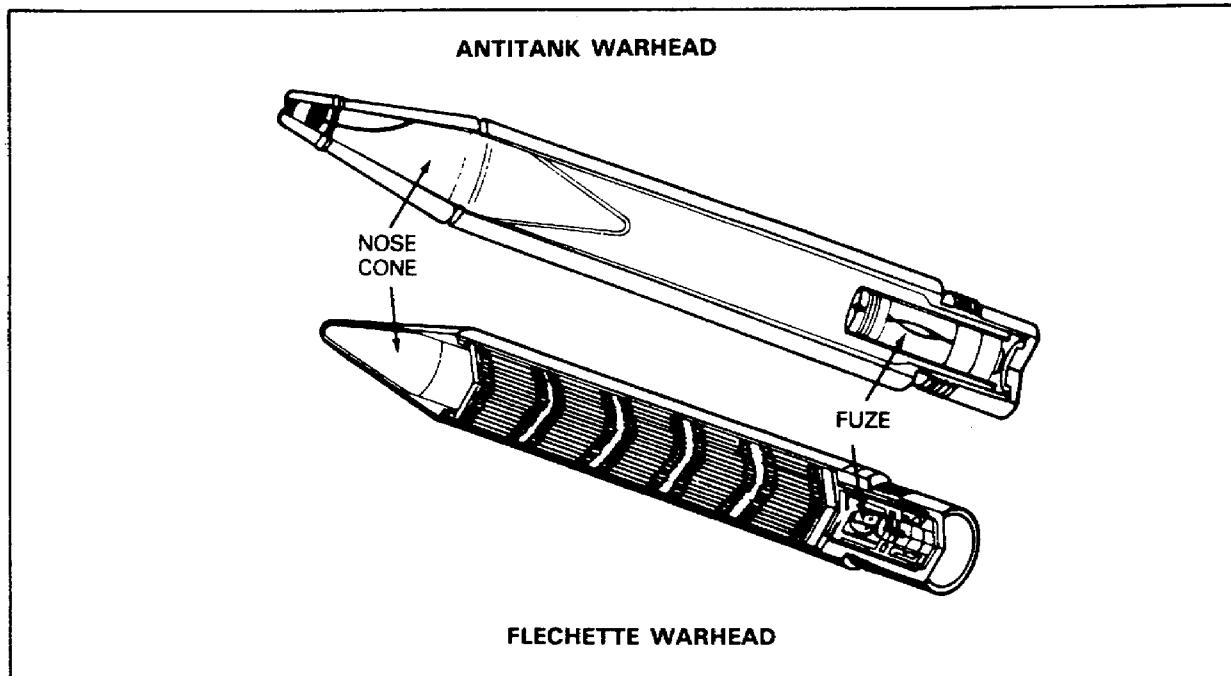


Figure 45. Two Types of 2.75-Inch Aircraft Rocket Warheads.

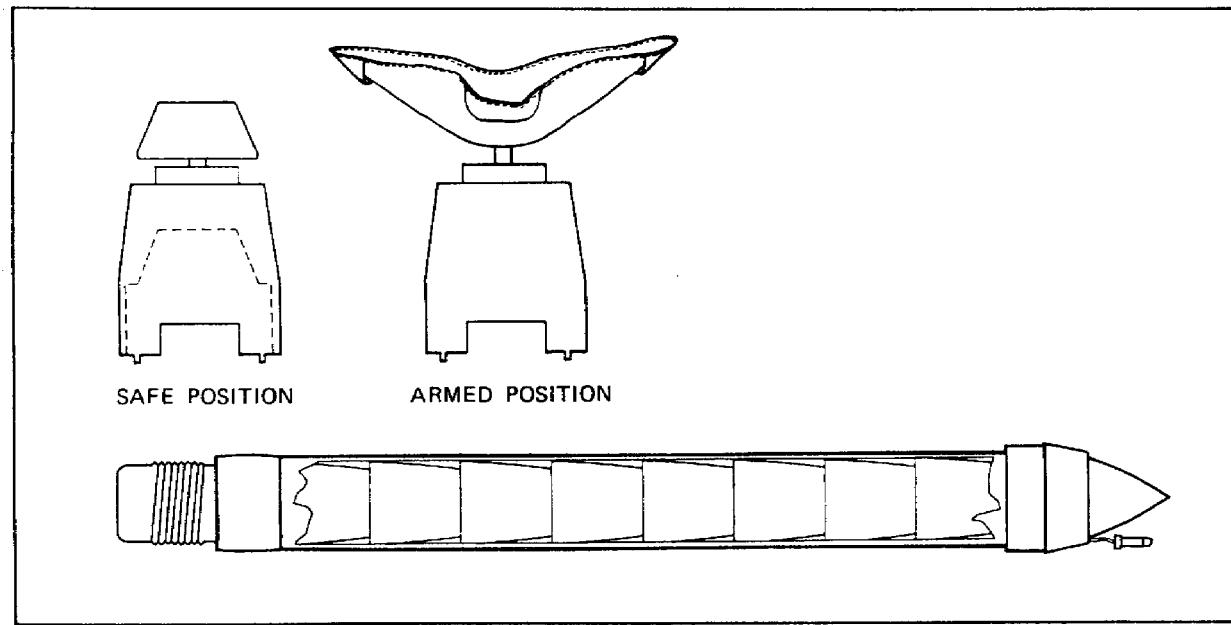


Figure 46. 2.75-Inch Rocket Multipurpose Submunition Warhead, M261.

The M261 MPSM warhead consists of a plastic nose cone assembly, an aluminum warhead case, an expulsion charge, nine full-caliber M73 submunitions, and an M439 RS fuze. Each submunition has a copper shaped-charge liner for armor penetration effects. The submunition's body wall contains a ram air decelerator (RAD) stabilizing device and is scored internally to optimize fragment size against personnel and materiel. Each

submunition is fuzed with an M230 fuze that will function regardless of impact angle. Each of the nine submunitions provides approximately 75 percent coverage of the lethal area against prone personnel as the HE M151 warhead.

The M267 MPSM practice round is a physical and ballistic match, and is almost identical in operation, to the M261 MPSM warhead. Three M75 practice submunitions, with a flash powder smoke signature and six inert submunition load simulators, take the place of the nine M73 submunitions in the M261 warhead. The M267 uses the M439 RS fuze. Both MPSM warheads will be mated to the MK66 motor and can be fired only from the M260 or M261 lightweight launcher.

**Motors.** The MK 4/40 rocket motor of the 2.75-inch aircraft rocket contains a single unit of solid propellant with a star-shaped perforation through the center. It has an electric igniter that uses electric current from the aircraft. The nozzle and fin assembly (Figure 47) is mounted on the back end of the motor. It has four folding fins that open to a 45-degree angle after launch. It has four nozzles, either cut straight across the end or "scarfed," cut

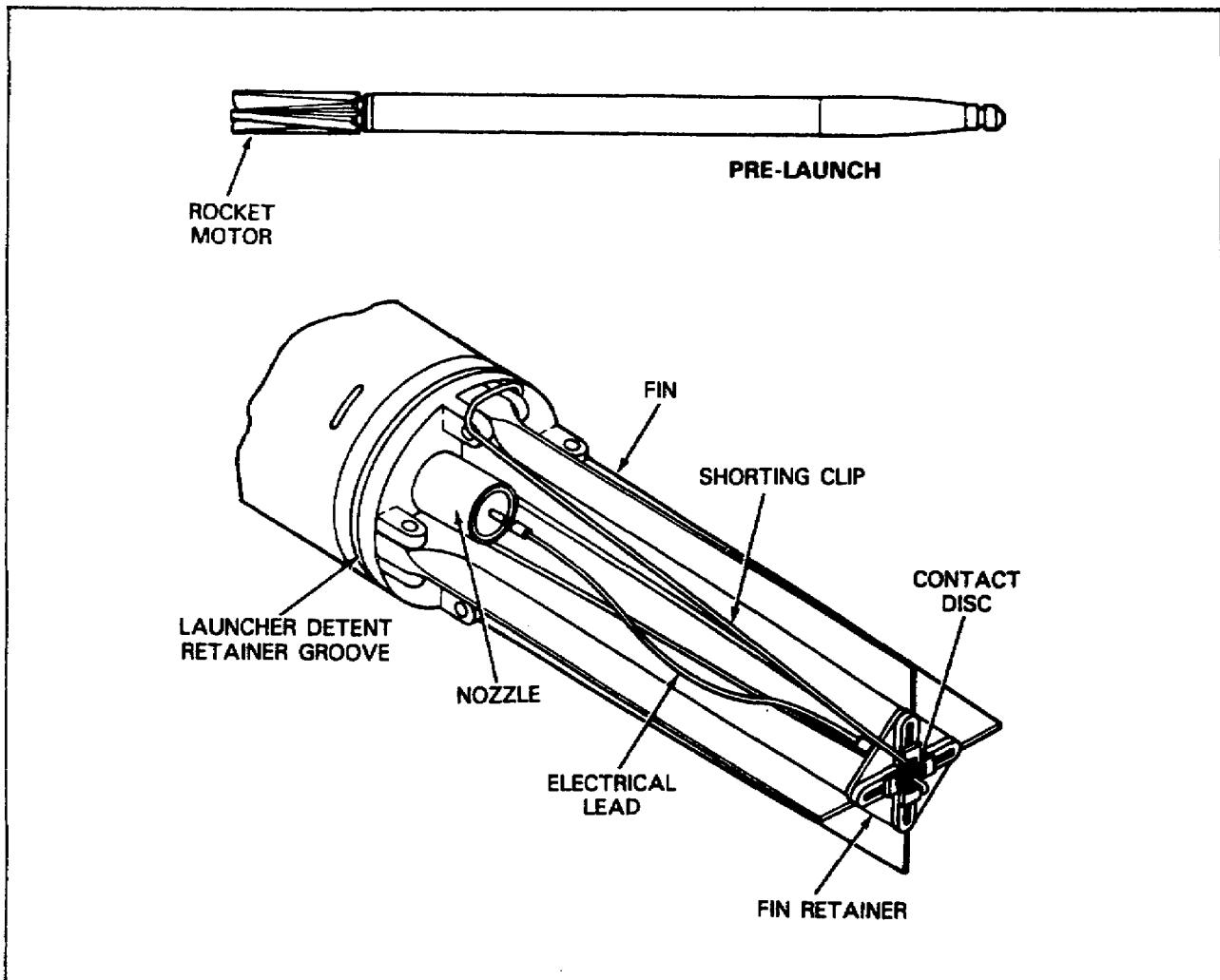


Figure 47. Characteristics of the 2.75-Inch Aircraft Rocket Nozzle and Fin Assembly.

off at an angle, which causes the rocket to spin in flight. The rocket with straight-cut nozzles is fired from fixed-wing aircraft; the rocket with scarf'd nozzles is fired from rotary-wing aircraft. The fins are held in the closed position by a contact disc assembly. A shorting clip wire grounds out the electrical firing circuit to prevent accidental firing by static electricity or stray current.

The new MK66 motor (Figure 48) was designed to provide a common 2.75-inch rocket motor for fixed-wing and rotary-wing aircraft. This motor utilizes a longer motor tube of a different aluminum alloy and a different nozzle and fin assembly than the MK 4/40 motor. The fins are of a spring-loaded, wrap-around design, and are attached around the circumference of the single nozzle. The propellant for the MK66 is an AA2 double-base propellant that is longer and of a different formulation than the MK 4/40 propellant grain. The MK66 spins up to 10 revolutions per second during exit from the launcher. The maximum rate of spin during motor burn is 35 revolutions per second. This provides trajectory stability for maximum accuracy and warhead effectiveness. The MK66 MOD 1 is the standard Army and Air Force motor.

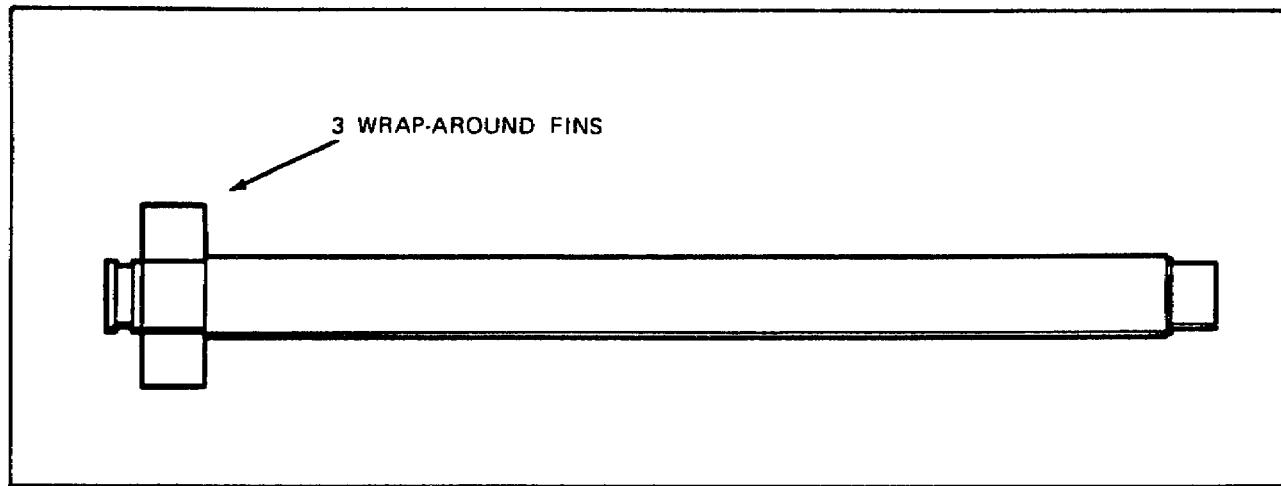


Figure 48. MK 66 2.75-Inch Rocket Motor, Mod 1.

**Packing.** The 2.75-inch aircraft rocket may be issued as a complete round or as separate components, with warhead, fuze, and rocket motor in separate containers. Complete rounds and rocket motors are packaged individually in fiber containers, with 3, 4, or 25 containers to a wooden box. See Figure 49. Aircraft that employ the 2.75-inch aircraft rocket are equipped with multiple-tube launchers (see Figure 50).

#### IDENTIFYING HAND GRENADES

A grenade is a lightweight missile filled with a high-explosive or a chemical. Grenades are used against enemy personnel or material at short ranges to supplement small arms fire. There are two types of grenades, the grenade thrown by hand and the grenade projected by a special blank cartridge from a rifle equipped with a grenade launcher or adapter. Rifle grenades are not used by US forces, so only hand grenades will be covered in this subcourse. There are five types of hand grenades: fragmentation, offensive, chemical, illuminating, and practice. See Figure 51. Most grenades are packed one grenade to a fiber container, with 30 fiber containers to a wooden box.

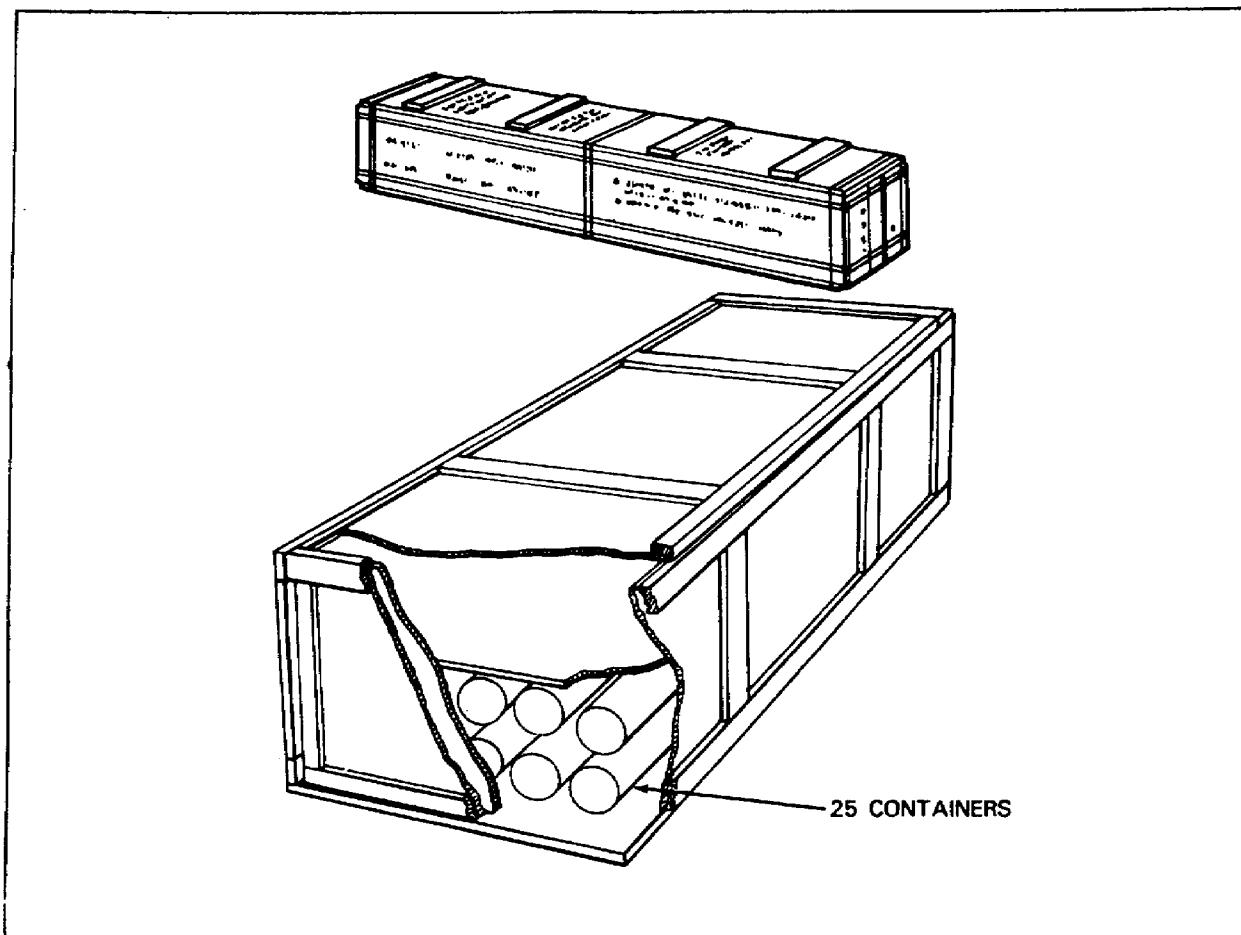


Figure 49. Two Types of 2.75-Inch Aircraft Rocket Boxes.

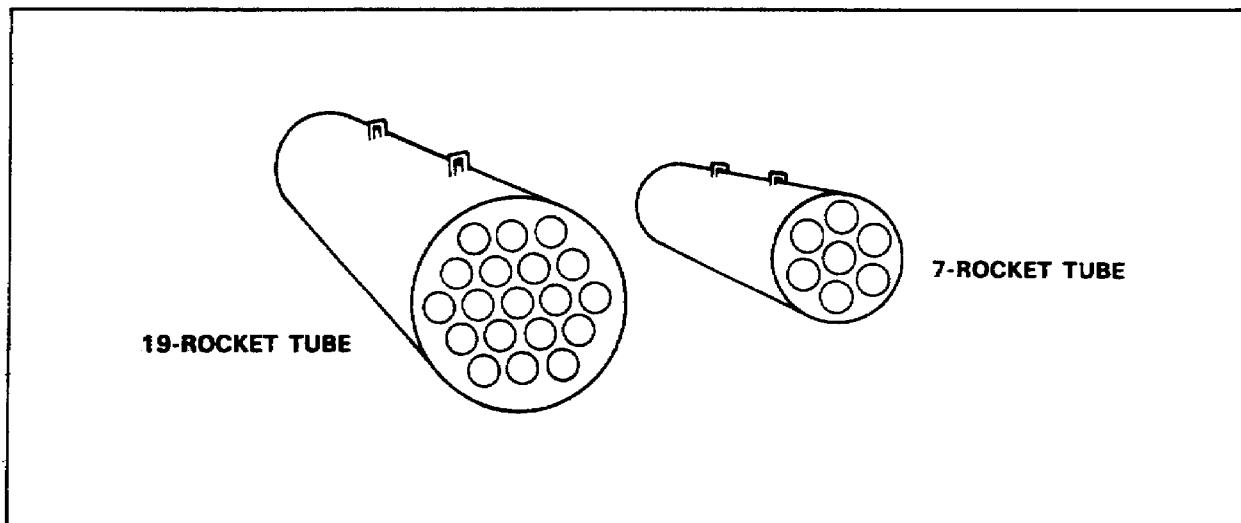


Figure 50. Two Types of 2.75-Inch Aircraft Rocket Launchers.

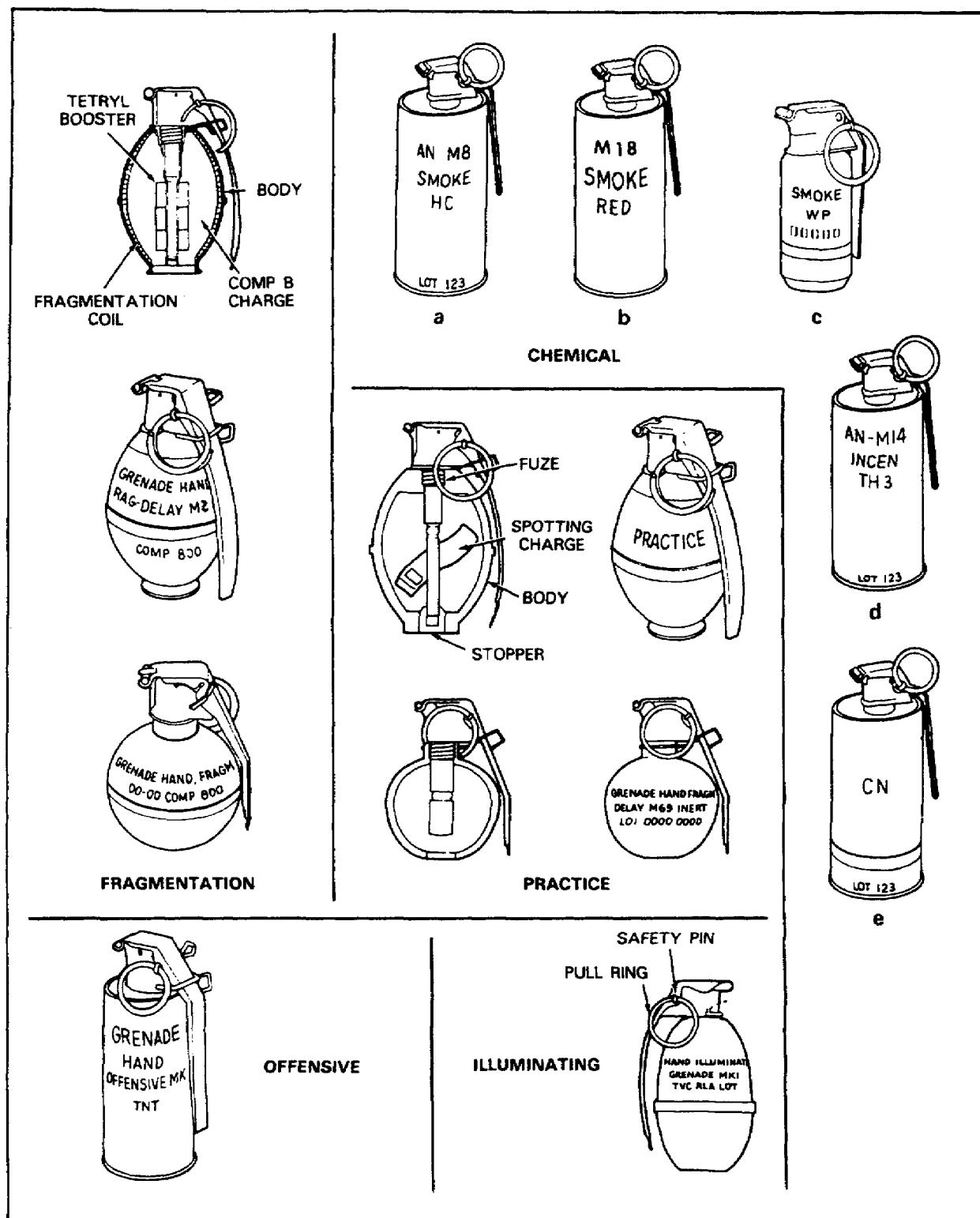


Figure 51. Types of Hand Grenades.

## Fragmentation Hand Grenades

Fragmentation hand grenades are used to cause casualties. They have a steel fragmentation coil under their thin metal outer body. This coil breaks up into small fragments that are scattered by a high-explosive charge.

There are two basic shapes for fragmentation grades, oval (egg-shaped) and round (baseball-shaped). They are color coded olive drab with yellow markings (high-explosive). The safety lever may be olive drab or red. If it is olive drab, the grenade has a delay fuze and will detonate four to five seconds after the safety lever is released. If it is red, the grenade has an impact fuze that detonates upon impact. This red color has nothing to do with the standard color coding system.

## Offensive Hand Grenades

The offensive hand grenade is used for blast and concussion effect or for demolition. It has no fragmentation effect. The offensive grenade consists of a fiber cylinder filled with TNT explosive and a four-to five-second delay fuze.

The offensive hand grenade is black with yellow markings. Yellow indicates a high-explosive filler; the black color has no significance. The body is impregnated with asphalt to make it weatherproof.

## Chemical Hand Grenades

Chemical hand grenades are used to produce smoke (screening, spotting, or signaling); to produce incendiary effects; or to control riots. There are five basic types: smoke grenades, colored smoke grenades, smoke-white phosphorous grenades, incendiary grenades, and riot-control grenades.

Chemical hand grenades are of either the burning or the bursting type. The burning type uses a fuze that ignites the filler. As the filler burns, smoke or chemical gas is emitted through emission holes in the grenade body that are covered with tape before the grenade is activated. The bursting type uses a fuze with a high-explosive detonator that ruptures the grenade body and scatters the filler when the grenade is activated.

**Smoke Grenades.** The body of the burning type of smoke grenade (Figure 51a) is made of lightweight metal and resembles a beverage can. The top of the body has four emission holes that are covered with tape and painted over. When the filler ignites, pressure blows the tape free, allowing the smoke to escape. The smoke grenade in the illustration is HC (white smoke), which is used for signaling and screening. The burning type of smoke grenade is color coded light-green with black markings.

**Colored Smoke Grenades.** The burning type of smoke grenade is also available in grenades that emit smoke in various colors. These grenades (Figure 51b) are identical in appearance to the HC (white smoke) grenade, except that the top of the grenade body of the colored smoke grenade is painted the same color as the smoke it produces. They are available in four colors: red, green, yellow, and violet.

**Smoke-White Phosphorous Grenades.** The smoke-white phosphorous grenade (Figure 51c) is a bursting type of grenade. It is used for incendiary purposes as well as for signaling and screening. It contains a white phosphorous mixture and a high-explosive charge that ruptures the grenade body and disperses the white phosphorous mixture. White phosphorous ignites upon contact with the air, producing smoke and incendiary effects. The smoke-white phosphorous grenade is color coded light-green with light-red markings and a yellow band.

**Incendiary Grenades.** The incendiary grenade (Figure 51d) is identical in size and configuration to the burning type of smoke grenade, but it is much heavier. It contains an incendiary mixture called thermite

or thermite (TH3), and is used to produce intense heat – up to 4,000°F – to destroy equipment. The incendiary grenade is color coded light-red with black markings.

**Riot-Control Grenades.** Riot-control grenades (Figure 51e) are used to control prisoners and crowds, to neutralize bunkers and tunnels, and to simulate casualty agents during training. A riot-control grenade has the same beverage-can appearance as smoke and incendiary grenades, but it is filled with tear gas mixture. As the mixture burns, tear gas is emitted from the emission holes. Riot-control grenades are color coded gray with dark-red markings and a dark-red band.

### **Illuminating Hand Grenades**

Illuminating hand grenades are used for illumination and signaling. Because of the high temperature generated by the burning illuminant, they may also be used for incendiary purposes against combustible targets. At first glance, the illuminating hand grenade seems to look just like the fragmentation hand grenade. A closer inspection, however, reveals obvious differences in shape and a body made of two pieces joined together. This grenade is found in two color codes, all white with black markings or unpainted with a white band and white markings.

### **Practice Hand Grenades**

Except for their color code, oval practice hand grenades look identical to fragmentation grenades. They have a hollow steel body, a fuze, a small spotting charge, and a plastic stopper in the bottom. When the fuze functions, the spotting charge is ignited, the stopper is blown out, and a puff of smoke marks the impact point. The round practice hand grenade functions similarly, but it has no stopper and the spotting charge is in the fuze. This type makes a loud noise as well as a puff of smoke. Practice hand grenades are color coded blue with a brown band and white markings.

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## **IDENTIFYING LAND MINES**

A land mine is a device filled with a high-explosive or a chemical that is placed above or below the ground to be detonated when a target touches or moves near it. Land mines are classified according to purpose as service or practice. They are classified by filler as high-explosive, chemical, or inert. The most commonly known method of classification, however, is by use-antipersonnel (apers) and antitank (at).

### **Antipersonnel (apers) Mines**

There are two basic types of antipersonnel mines, the blast type, which explodes without fragmentation, and the fragmentation type, which explodes with fragmentation. Fragmentation mines are further divided into bounding and fixed-directional types.

The bounding fragmentation type is placed beneath the surface of the ground. When it functions, a fragmentation projectile is expelled to a height of one to two meters, where it detonates, fragmenting in all directions. The fixed-directional fragmentation type is placed on the ground or attached to a stationary object such as a tree or pole. It faces the expected path of the enemy. When it functions, the fragments fan outward horizontally above the ground.

Four of the antipersonnel mines now in US Army stocks include: mine, antipersonnel, nonmetallic, M14; mine, antipersonnel, fragmentation bounding, M16; mine, antipersonnel, fragmentation bounding, M26; and mine, antipersonnel, M18A1.

**Mine, Antipersonnel, Nonmetallic, M14.** The M14 mine (Figure 52) is comparatively small. It is less than 2 1/2 inches in diameter and weighs only 3 1/3 ounces. The letters S and A on the fuze body indicate the Safe and Armed positions of the pressure plate. All mines have three safety measures. On the M14 antipersonnel mine: (1) The pressure plate must be set on A before the mine can function. (2) A metal safety clip must be removed before the mine can be set on A. (3) The detonator assembly is packed in separate pieces within the same shipping container and is only installed immediately before use.

The M14 mine is color coded olive drab with black and yellow markings. The M14 practice mine is identical in appearance to the service type except for its color code, which is blue with white markings. It contains a small spotting charge.

M14 mines and detonators are packed one each to a cardboard carton, with 90 cartons and nine safe-and-arm wrenches (to turn the pressure plates to the S and A positions) to a wooden box.

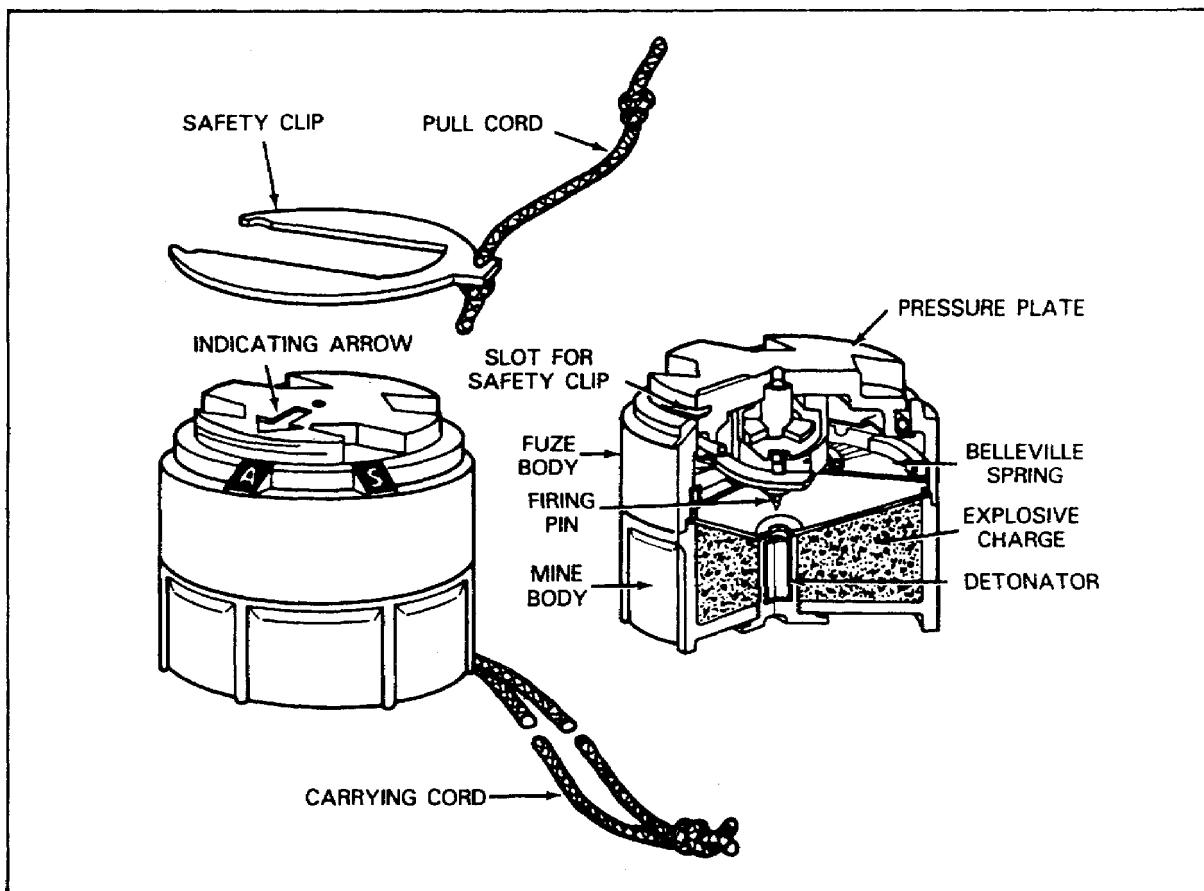


Figure 52. Mine, Antipersonnel, Nonmetallic, M14.

**Mine, Antipersonnel, Fragmentation Bounding, M16.** The M16 mine (Figure 53) is sometimes referred to as the "tomato can," because the outer case is made of lightweight metal and it looks like a tin can. It is equipped with a fuze that can be activated by pressure or by a trip wire. When the fuze is activated, the inner projectile is ejected. When the projectile reaches a height of between one and two meters, it detonates, throwing fragments in all directions.

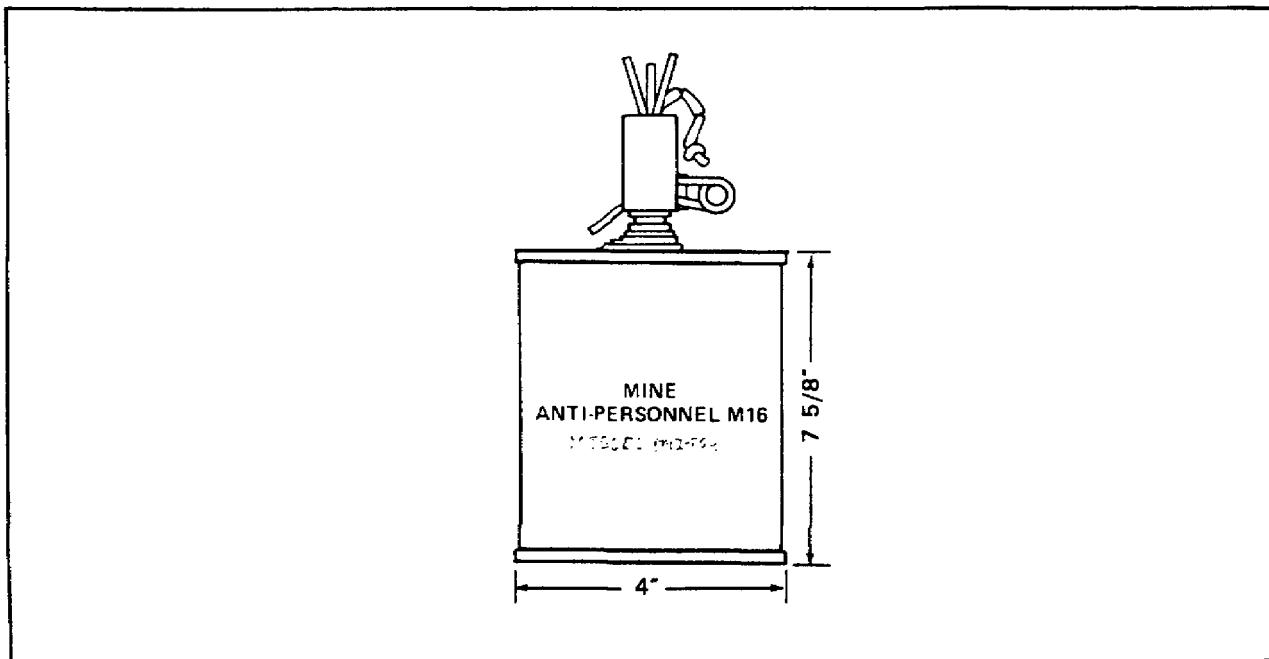


Figure 53. Mine, Antipersonnel, Fragmentation Bounding, M16.

The M16 antipersonnel fragmentation bounding mine is color coded olive drab with yellow markings. It is packed unfuzed; the fuzes are packed separately in the same shipping container. Four mines, four fuzes, two or four spools of wire, and a wrench are packed in each wooden box.

**Mine, Antipersonnel, Fragmentation Bounding, M26.** The M26 mine (Figure 54) is a newer antipersonnel mine. It functions the same way as the M16 mine, ejecting a projectile that detonates one to two meters above the ground. It is simpler to use though, because the spools of wire and other accessories are packaged with the mine as a complete unit.

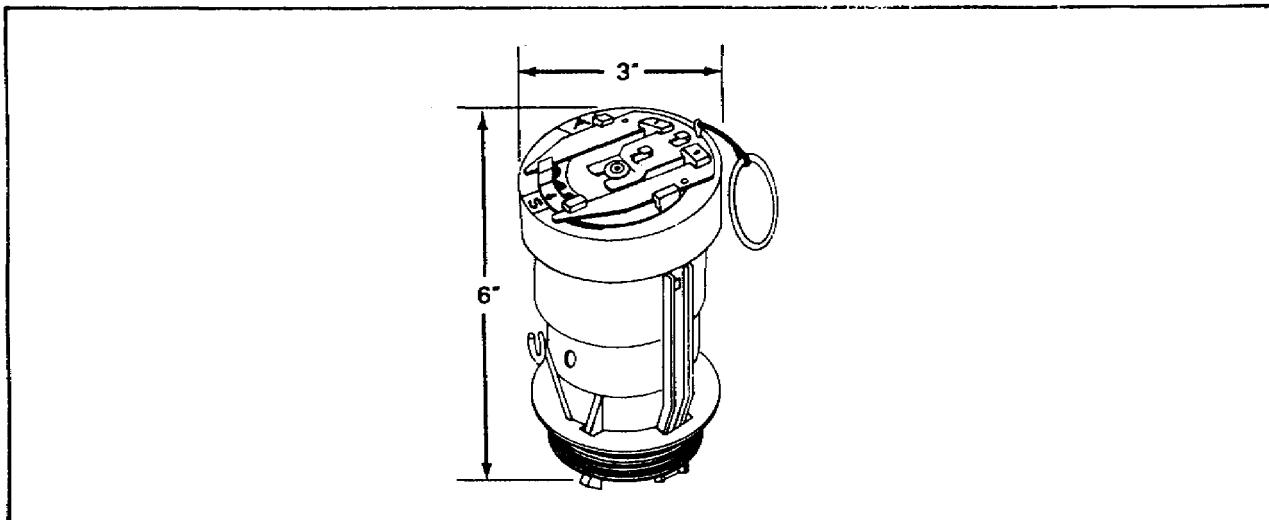


Figure 54. Mine, Antipersonnel, Fragmentation Bounding, M26.

The M26 mine is color coded olive drab with yellow markings. It is packed three to a fiber container, with six containers in a wooden box.

**Mine, Antipersonnel, M18A1.** The M18A1 mine (Figure 55) is a directional, fixed, fragmentation mine used in defense of positions. This mine, often called the Claymore, consists of a curved fiberglass case filled with a high-explosive and small steel spheres. It is positioned on scissors-type folding legs and aimed in the desired direction by a sight.

The M18A1 mine can be command-detonated using an electric blasting cap and an electric firing device. It can also be booby-trapped using a trip wire, a detonating cord, and a nonelectric blasting cap.

The M18A1 mine's body is about 8 1/2 inches long, 3 1/4 inches high, and 1 1/2 inches thick. Its case is olive drab. The mine is packaged with all its accessories in a bandoleer, with six bandoleers to a wooden box.

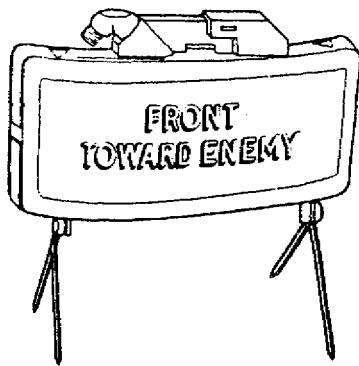


Figure 55. Mine, Antipersonnel, M18A1.

#### Antitank (at) Mines

There are three basic types of antitank mines: heavy metallic, heavy nonmetallic, and off-route. Four of the antitank mines now in US Army stocks include: mine, antitank, HE, heavy, M15; mine, antitank, HE, M21; mine, antitank, HE, nonmetallic, M19; and mine, antitank, HE, M24.

**Mine, Antitank, HE, Heavy, M15.** The M15 antitank mine (Figure 56) is a heavy metallic mine. It is used against heavy tanks, heavy tracked vehicles, and heavy wheeled vehicles. It has a steel cylindrical body approximately 13 inches in diameter and 5 inches high, and it contains more than 22 pounds of high-explosive.

To activate, the safe and armed plug of the M15 mine is removed and a fuze is installed in a fuze well under the plug. When the selector is placed on Armed, the mine can be detonated by 350 to 750 pounds of pressure on the pressure plate. It has secondary fuze wells on one side and on the bottom, where an activator may be inserted for booby-trapping.

The M15 antitank mine is color coded olive drab with yellow markings. It is packed one mine to a wooden box, with one fuze and one booby-trapping activator in separate metal containers in the same box.

**Mine, Antitank, HE, M21.** The M21 antitank mine (Figure 57) is another heavy metallic mine. It is designed to penetrate 3 inches of armor plate from a distance of 21 inches. It also functions as a blast type of mine. It has a cylindrical steel body 9 inches in diameter and 5 inches high, and it contains 11 pounds of high-explosive. The fuze is actuated by a slight horizontal push at the top of the tilt rod or by a downward force of 290 pounds.

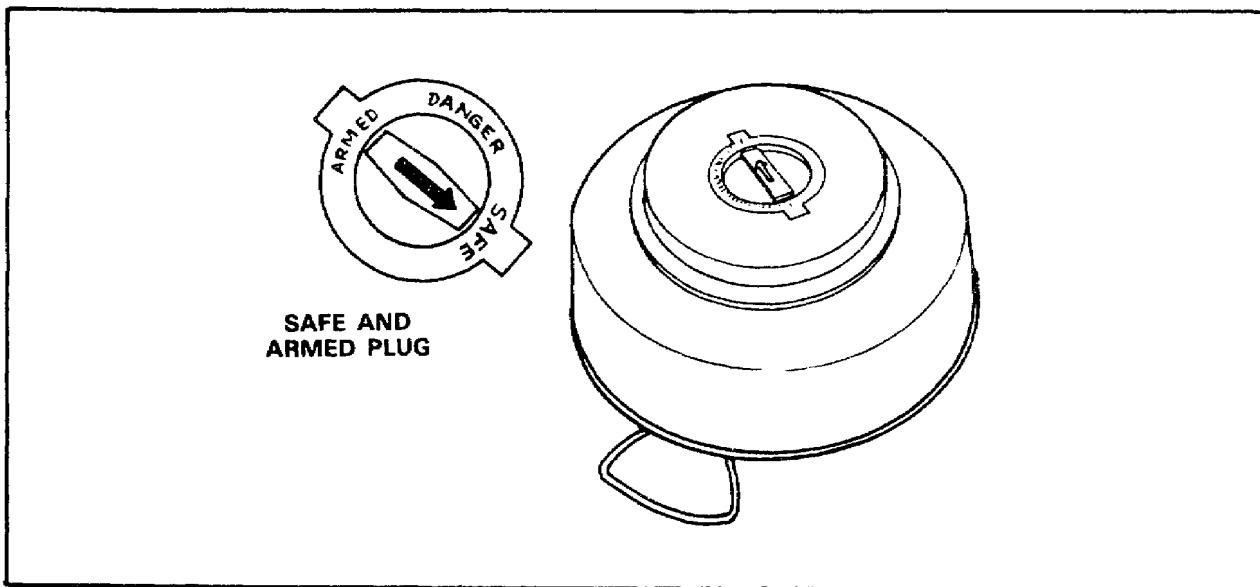


Figure 56. Mine, Antitank, HE, Heavy, M15.

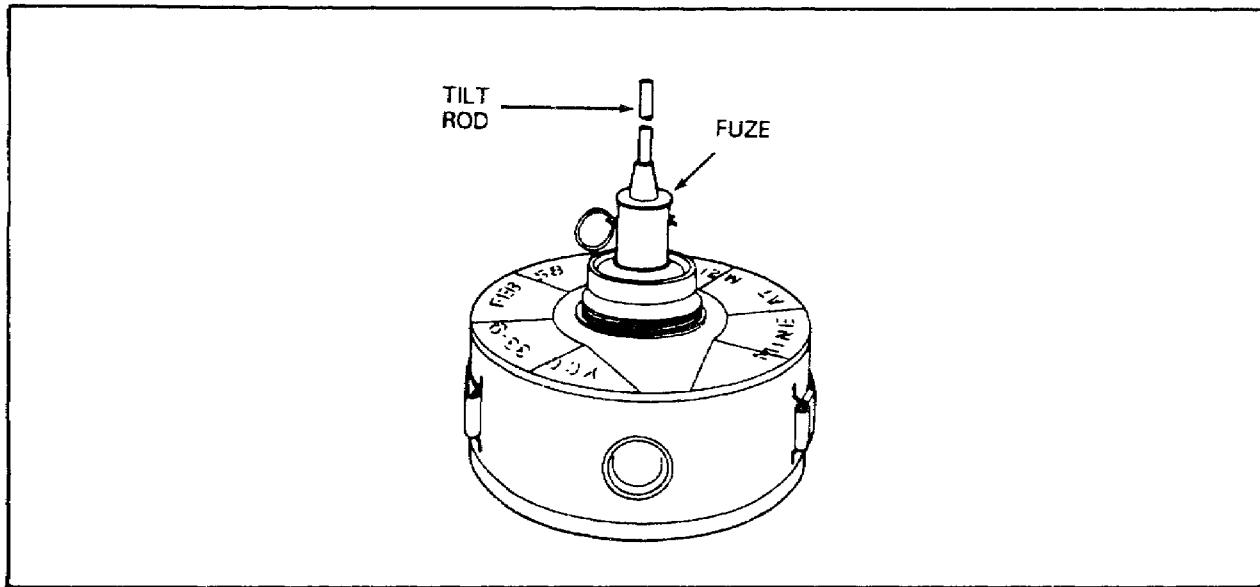


Figure 57. Mine, Antitank, HE, M21.

The M21 antitank mine is color coded olive drab with yellow markings. It is packed two mines, two fuzes, and two boosters (not installed) to a plastic barrier bag, with two bags to a wooden box.

**Mine, Antitank, HE, Nonmetallic, M19.** The M19 antitank mine (Figure 58) is nearly all plastic, so it is not detectable by magnetic mine detectors. This mine is easily identified by its box shape approximately 13 inches square by 3 inches high.

The pressure plate of the M19 antitank mine is also the fuze assembly, with a safe and armed selector. When the selector is in the Armed position, a force of 300 to 500 pounds will activate the fuze.

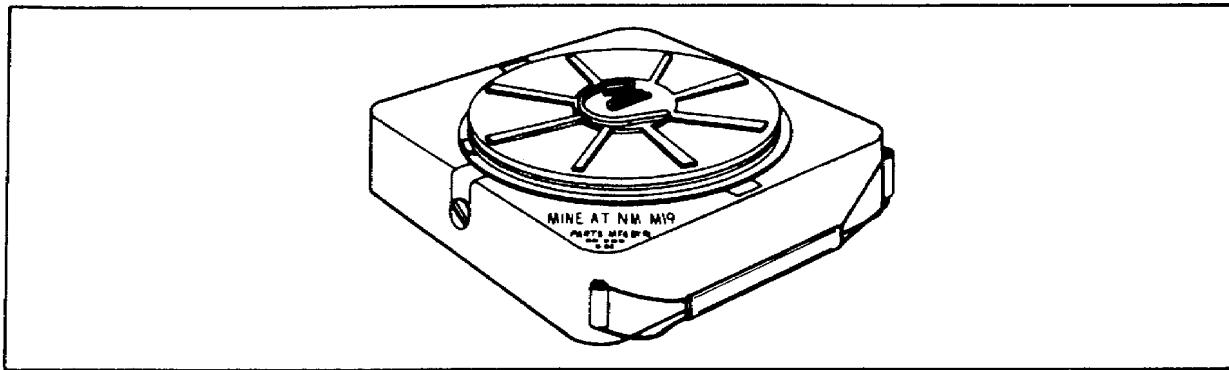


Figure 58. Mine, Antitank, HE, Nonmetallic, M19.

The M19 antitank mine is olive drab plastic with yellow or embossed markings. It is packed with the fuze installed but without the detonator, which is separate in the same container. Two mines, two fuzes, two activators, and one wrench are packed in a waterproof barrier bag. Two of these bags are packed to a wire-bound box.

**Mine, Antitank, HE, M24.** The M24 antitank mine (Figure 59) is an off-route antitank mine operated remotely to defend against all types of enemy vehicles. It consists of a modified 3.5-inch antitank rocket; a launcher (24-inch plastic tube); a sighting assembly (to aim the launcher); a discriminator assembly (discriminator is a cable laid across a route, which when run over, fires the rocket); and a firing device (provides electricity to fire the rocket).

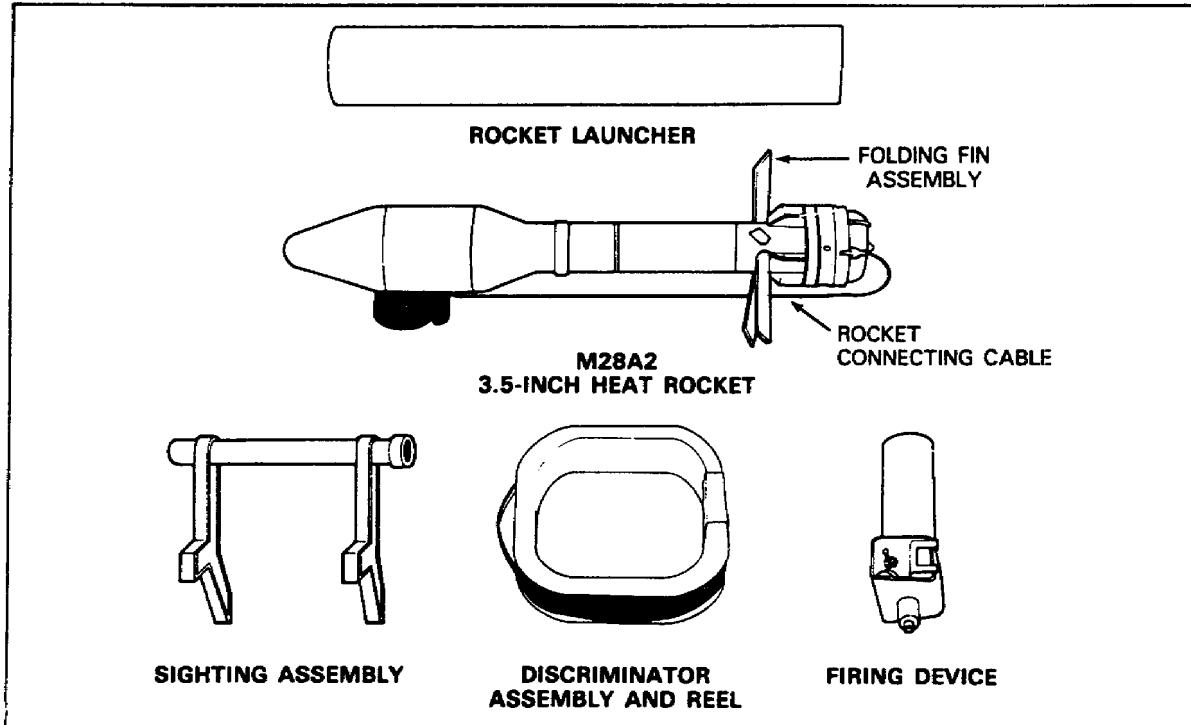


Figure 59. Mine, Antitank, HE, M24.

The M24 antitank mine is color coded olive drab with yellow markings. It is packed two complete kits to a wire-bound box.

### Practice Mines

Practice mines are usually identical in appearance and weight to the service mines they represent. They contain no high-explosive; but they are usually equipped with a fuze containing a smaller igniter charge, and they may have a small quantity of low explosive to simulate the mine function with smoke or a small explosion. The practice mine in Figure 60 simulates the function of the M16 and M26 bounding antipersonnel mines. It has a cardboard projectile containing a spotting charge.

Practice mines are color coded blue with white markings. An exception is the antitank mine, training, M80. This mine is identical in appearance to the antitank mine, nonmetallic, M19, but may be color coded all bronze or olive drab with bronze-colored circles. The word "inert" is stenciled or stamped on the mine body.

### Chemical Land Mines

Chemical land mines are used to contaminate an area with a chemical agent. They are filled with a chemical agent and use a high-explosive to disperse the agent. No chemical land mines are now in stock. Their color code would be gray with dark-green markings and dark-green bands.

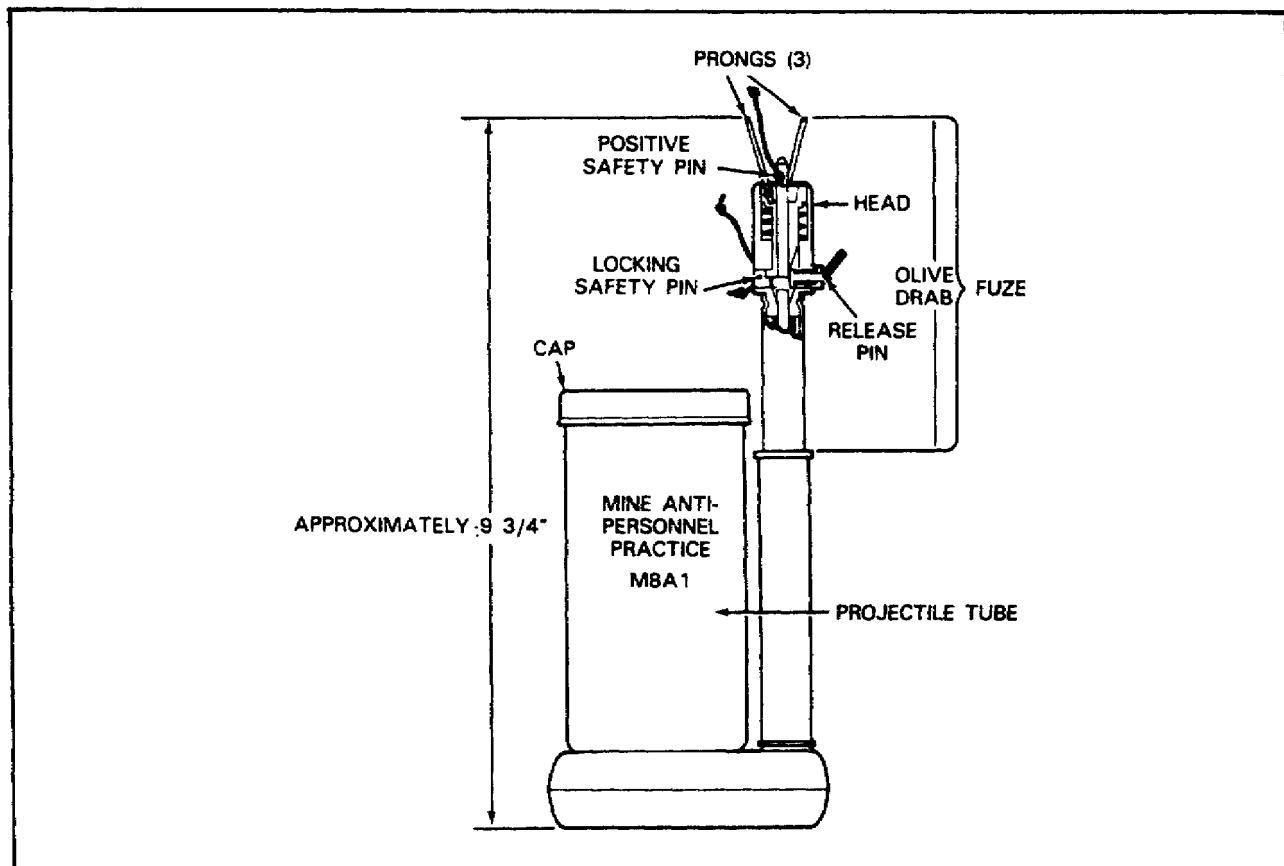


Figure 60. Practice Bounding-Type Antipersonnel Mine.

## IDENTIFYING FUZES

A fuze is a device with explosive components designed to initiate an explosive train in an item of ammunition. There are many types of fuzes, but the three basic types are grenade fuzes, mine fuzes, and mortar and artillery fuzes. (Packing for fuzes was covered on page 20 and in Figure 19.)

### Grenade Fuzes

There are two basic functional types of grenade fuzes, delay and impact.

**Delay Grenade Fuze.** The delay grenade fuze contains a delay element made of a slow-burning material. Delay fuzes are of two types. The delay fuze used with chemical burning grenades has a small igniter to ignite the chemical compound in the grenade. The delay fuze used in high-explosive fragmentation or white phosphorous grenades has a small high-explosive detonator that extends deep into the filler of the grenade. See Figure 61.

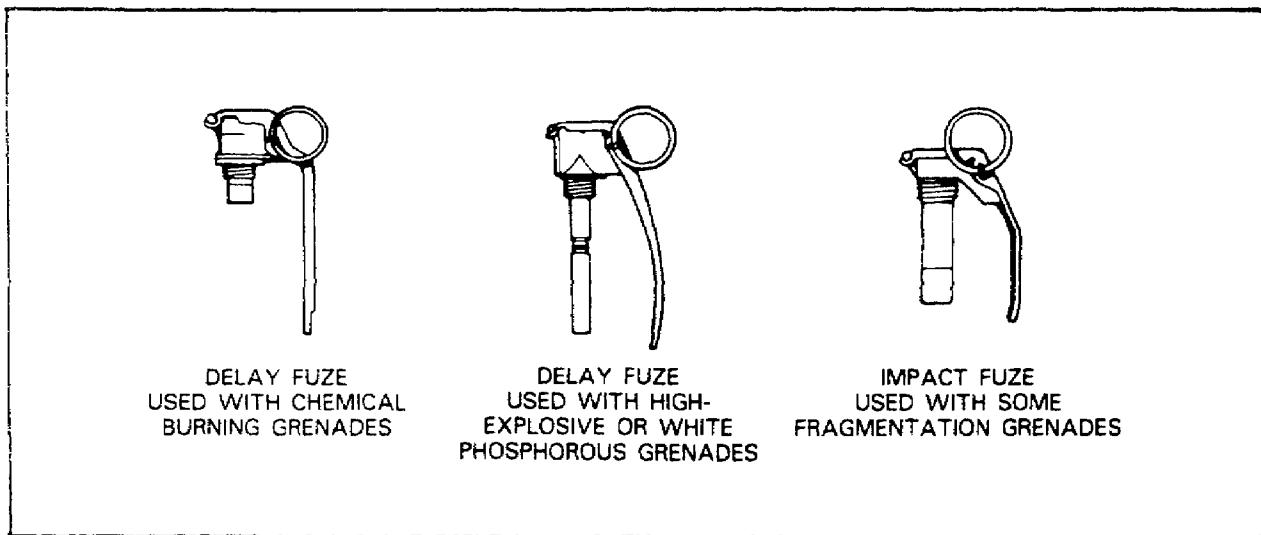


Figure 61. Basic Types of Grenade Fuzes.

**Impact Grenade Fuze.** The impact grenade fuze (see Figure 61) detonates the grenade upon impact. This fuze also contains a delay element. This element causes the grenade to detonate three to seven seconds after the safety lever is released.

**Identifying Grenade Fuzes.** The impact fuze is easily identified by its thick detonator and short safety lever. The safety lever may also be color coded red or have the word "impact" stamped on it, or both. The delay fuze used with the burning type of grenade has a safety lever bent to fit the beverage-can shape of the grenade. The type used with high-explosive and bursting chemical grenades has a curved lever and a long detonator. All grenade fuzes have a similar pull ring, safety lever, and striker assembly. Some have an additional safety wire clip.

### Mine Fuzes

There are two basic types of mine fuzes, the combination type used with antipersonnel mines and the pressure type used with antitank mines.

**Combination Mine Fuze.** The combination mine fuze (Figure 62) functions by pressure on the three prongs on top or by a trip wire attached to the release pin ring on the side. Some combination mine fuzes are equipped with a flash igniter that activates the mine. The combination fuze is easily identified by its three pressure prongs and the release pin ring.

The combination fuze is issued with two safety pins installed, a primary safety pin and a secondary safety pin. The primary safety pin is inserted through the firing pin at the top. The secondary safety pin is a cotter pin inserted through the body.

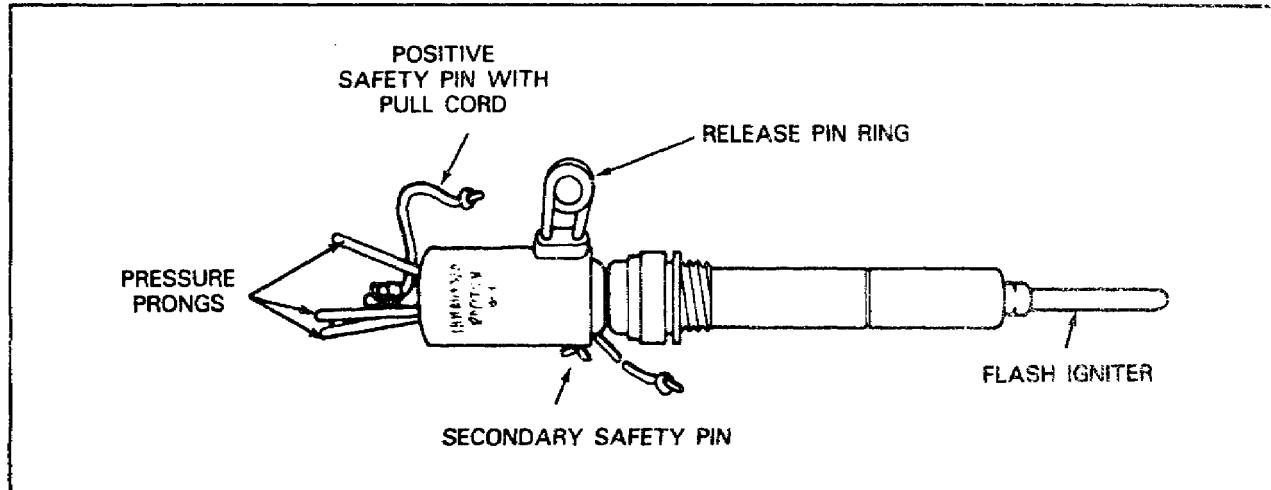


Figure 62. Combination Mine Fuze

**Pressure Mine Fuze.** The pressure type of mine fuze may be an integral part of the mine or be separate from the mine. The fuze shown in Figure 63 is about 1 1/4 inches in diameter and made of unpainted metal. The markings are stamped in the side of the fuze body. The fuze has a safety fork that prevents the pressure plate from being pressed before installation. The practice version is identical to the service version, except that it is painted blue with white markings and contains a small smoke charge instead of a detonator.

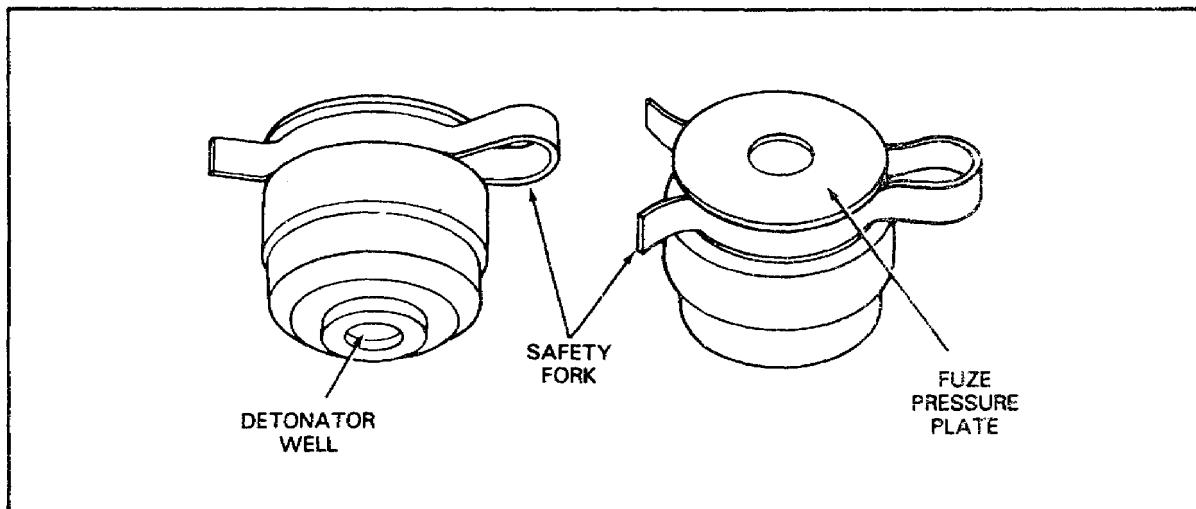


Figure 63. Pressure Type of Mine Fuze for the M15 HE Heavy Antitank Mine.

The fuze shown in Figure 64 functions by horizontal pressure on the tilt rod or, with the tilt rod removed, by pressure on the top of the fuze itself. This fuze is easily identified by its tilt rod (or the tilt rod hole when the tilt rod has been removed) and the safety band secured by a cotter pin and pull ring that prevents tilt or pressure before installation. It has a secondary safety – a closure assembly screwed on the bottom. The closure assembly has two prongs that act as a safety fork. They hold the firing pin in a safe position until the closure assembly is removed. The fuze is color coded olive drab with yellow markings. The practice version is blue with white markings.

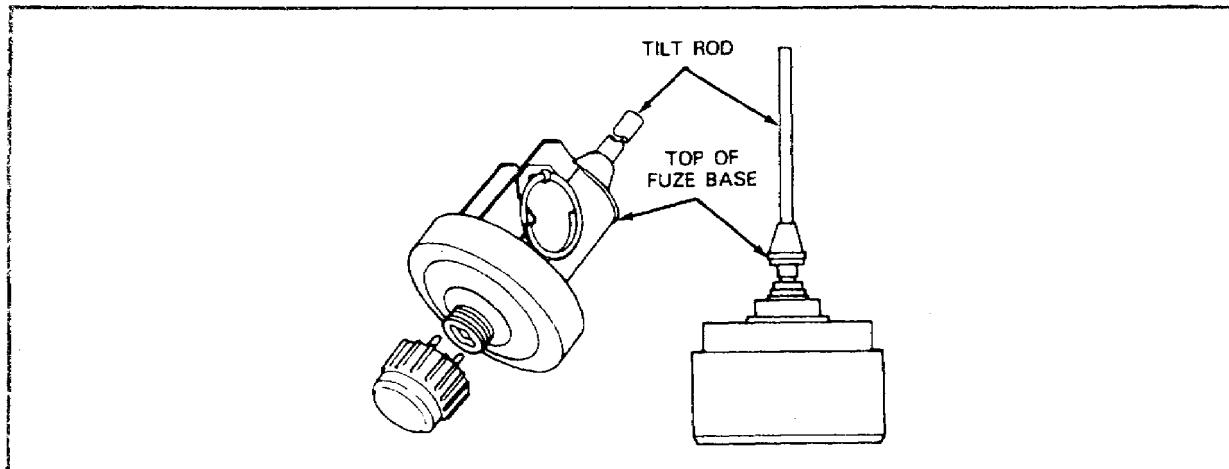


Figure 64. Pressure Type of Mine Fuze for the M21 HE Antitank Mine.

### Mortar and Artillery Fuzes

The four types of mortar and artillery fuzes that will be covered in this subcourse are point-detonating fuzes, time (mechanical time and powder train time) fuzes, proximity fuzes, and electronic time fuzes. Proximity and electronic time fuzes are types of time fuzes, but they are discussed separately here because of their special characteristics.

**Point-Detonating Fuzes.** The fuze illustrated in Figure 65 is a typical point-detonating (PD) fuze used with artillery ammunition. Note that the markings are engraved at the base of the head assembly with the type of fuze and the model number. Below the head assembly is a booster assembly.

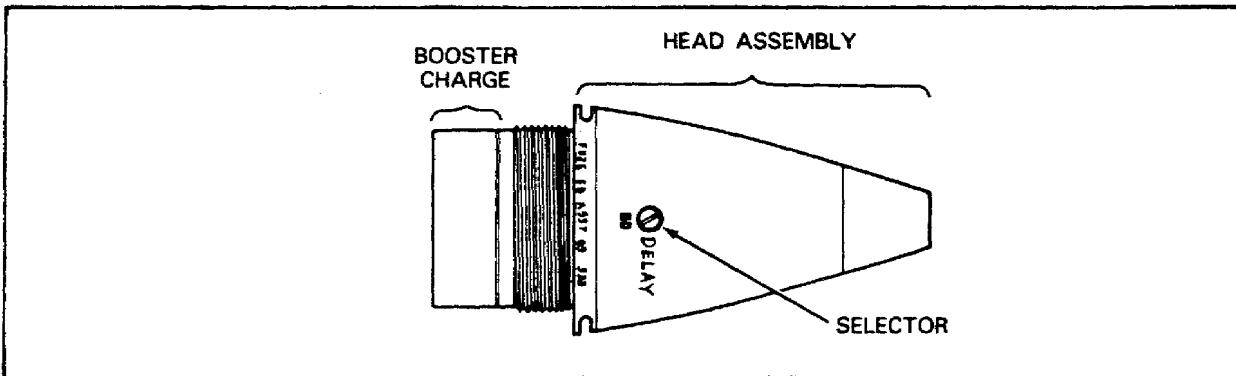


Figure 65. Artillery PD Fuze.

When the fuze is screwed into the fuze cavity of an artillery projectile, the booster extends into the main charge of the projectile. At the bottom of the booster assembly is a small high-explosive charge called the booster charge, which is detonated upon impact. This in turn, sets off the main charge in the projectile.

Note the selector on the fuze body. It has two positions, Sq and Delay. Sq means "superquick." When set in the Sq position, the fuze will function immediately upon impact. When set in the Delay position, the fuze will function .025 to .05 of a second after impact. This enables the projectile to penetrate the target slightly before detonating. The fuze is issued with the selector in the Sq position.

The point-detonating fuze for mortar ammunition is shown in Figure 66. Note how it differs from the artillery type. It has a spring-loaded striker in its nose end, a safety wire inserted through the arming mechanism for safety in handling, and a bore riding pin (which prevents the fuze from arming until the round has been fired from the mortar tube).

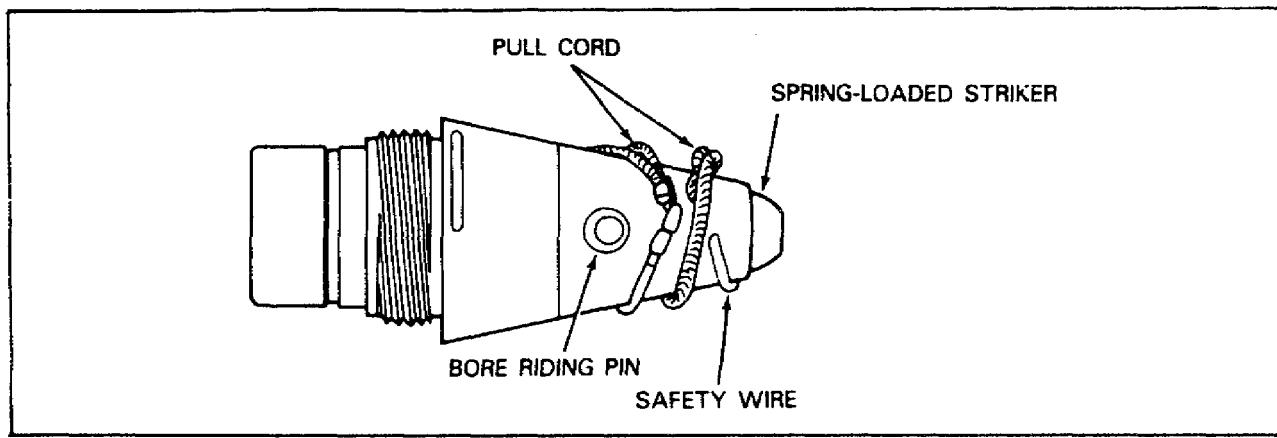


Figure 66. Mortar PD Fuze.

**Time Fuze.** Time fuzes are designed to detonate a projectile at a set time after the projectile is fired. They are also designed to function upon impact if the projectile impacts an object before the set time has elapsed or if the timing mechanism fails.

**Mechanical Time Fuze.** The mechanical time (MT) fuze (Figure 67) contains a clock mechanism. The clock mechanism is set to a specific time before the round is fired. The clock starts when the round is fired. When the set time has expired, the round detonates. This fuze can be identified by the time scale encircling its body. Mechanical time fuzes may be unpainted with engraved markings or black with white engraved markings.

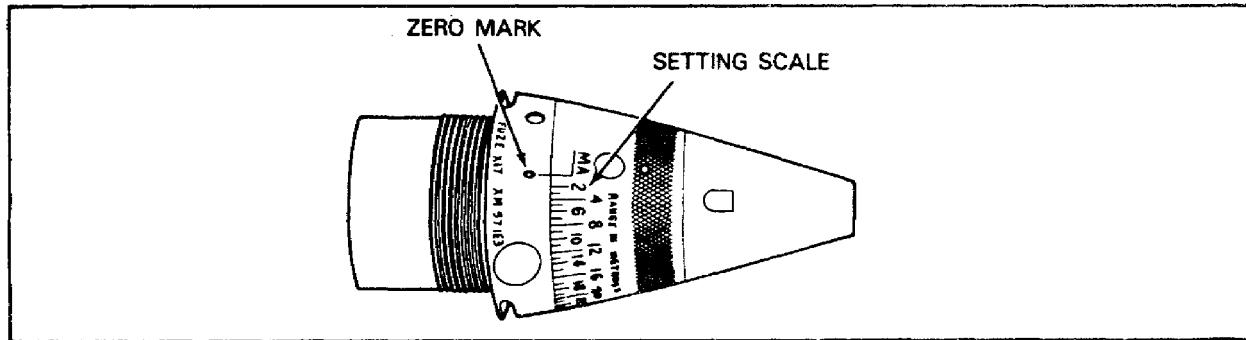


Figure 67. Typical MT Fuze.

**Mechanical Time, Superquick Fuze.** The mechanical time, superquick (MTSQ) fuze has a clock mechanism similar to that of the mechanical time fuze. It can also be set to function upon impact with a target. Older model mechanical time, superquick fuzes (Figure 68) have a time scale encircling the fuze body. The time scale has an S (for safe) and time settings for up to 100 seconds. Some fuzes have a safety wire inserted through the time mechanism for safety in handling and shipping. Newer model mechanical time, superquick fuzes (Figure 69) do not have the time scale encircling the body. They have a transparent window in the side showing a digital time instead. The time is set by turning a screw in the nose end.

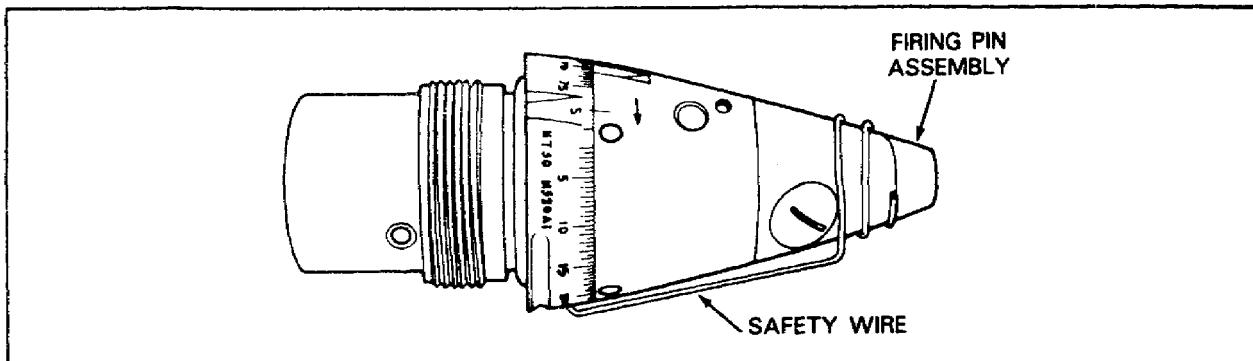


Figure 68. Typical MTSQ Fuze (Older Model).

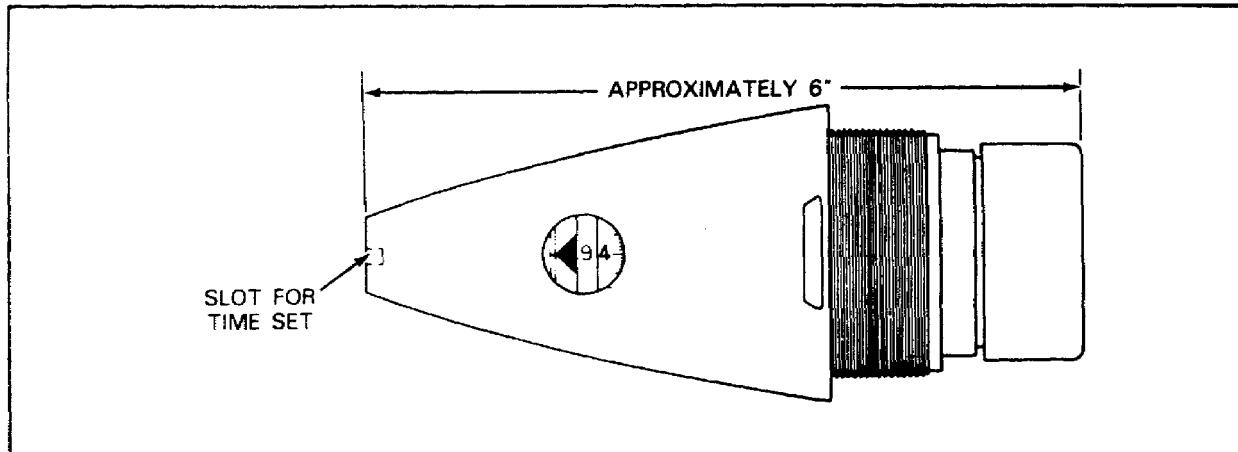


Figure 69. Typical MTSQ Fuze (Newer Model).

**Time (Powder Train) Fuze.** Figure 70 shows the only time fuze used with the 81mm mortar illuminating round. This fuze functions differently than mechanical time and mechanical time, superquick fuzes. Time is regulated by a slow-burning variable powder train. When the round is fired, the powder train in the fuze ignites and burns slowly until it ignites the expelling charge in the illuminating round. The length of the powder train can be adjusted by turning the circular scale. This fuze is easily identified by the large diameter of its threads and the absence of a booster assembly.

**Proximity.** The proximity fuze, also known as the variable time (VT) fuze, is readily identified by its olive drab plastic nose cone. Figure 71 shows the two proximity fuzes now used in 81mm mortar ammunition.

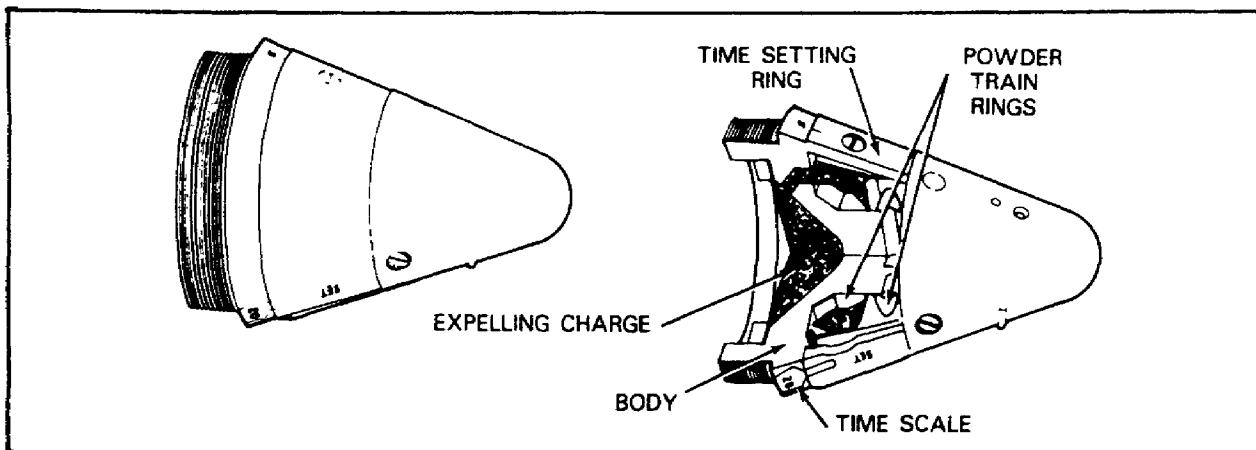


Figure 70. Fuze, Time, 81mm Mortar.

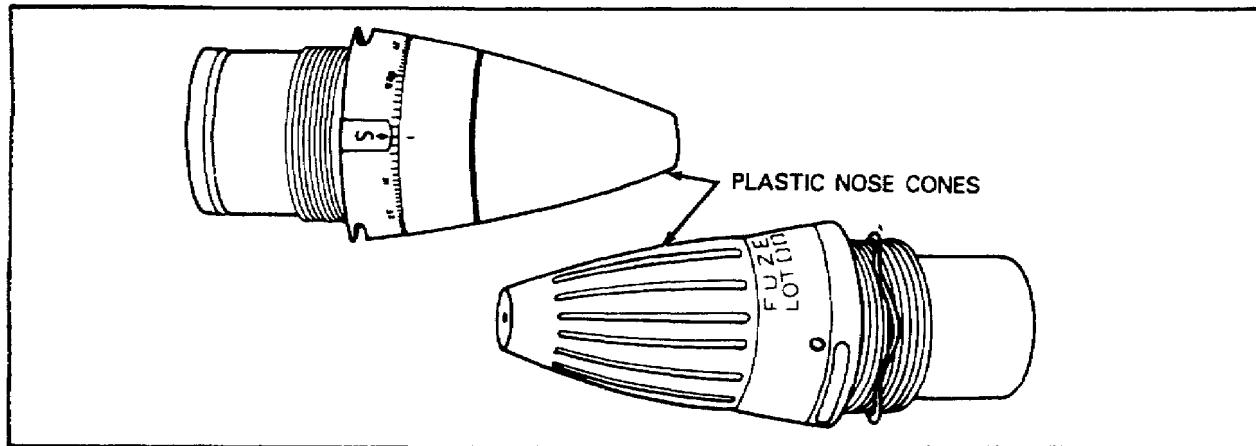


Figure 71. Proximity (VT) Fuze for 81mm Mortar.

The proximity fuze is unique in its function. It contains a small radio transmitter and receiver. When the round is fired, the battery is energized and the transmitter starts sending out radio waves. As the round descends, the waves bounce back from the ground and are picked up by the receiver. As the round gets closer to the ground, the waves bouncing back get stronger. When these waves reach a predetermined (preset) strength, the fuze detonates, exploding the round about 30 feet from the ground.

The proximity fuze used in gun, howitzer, and 4.2-inch mortar rounds (Figure 72) is different from the proximity fuzes used in the 81mm mortar round. It has the same plastic nose cone as the 81mm mortar round, but it also has a time scale encircling its body and an extended housing containing a booster and powder supply. The entire fuze is approximately 8.6 inches long. Supplementary charges must be removed from fuze wells before the fuze can be installed. The time scale makes it possible to adjust the height of the airburst. It can be set on point-detonating action so it will detonate on impact. All proximity fuzes will function on impact if the radio unit malfunctions.

**Electronic Time.** The electronic time (ET) fuze (Figure 73) uses a time system similar to an electric digital watch. It can be identified by its black anodized aluminum ogive and the time setting rings in its nose end. To set the fuze time, a special electric fuze setter is placed over the nose end, contacting the rings.

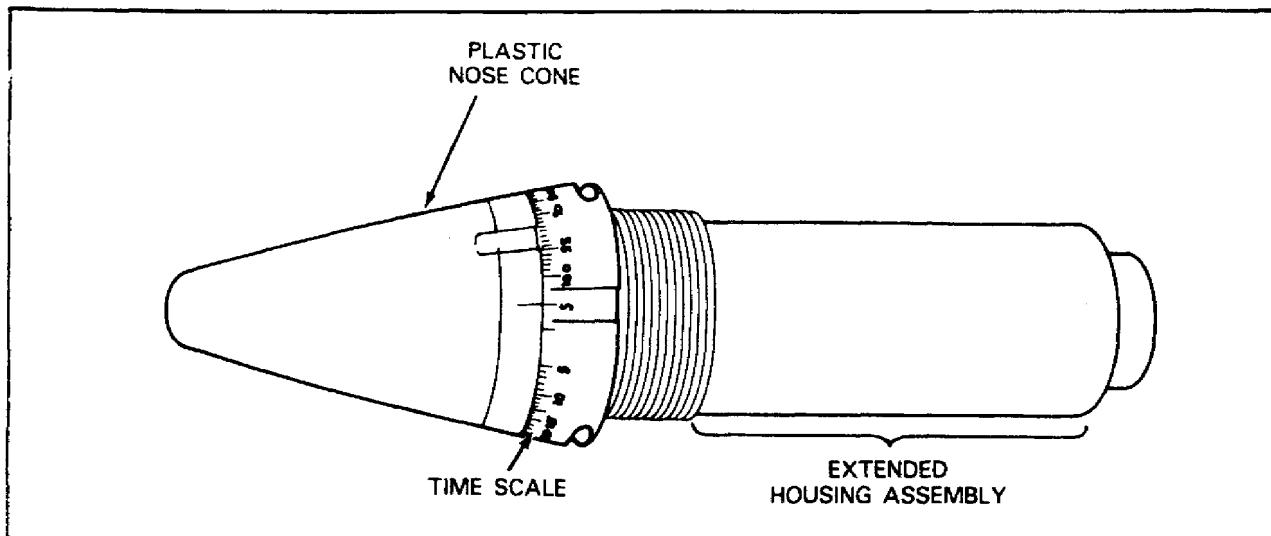


Figure 72. Proximity Fuze for Artillery Ammunition.

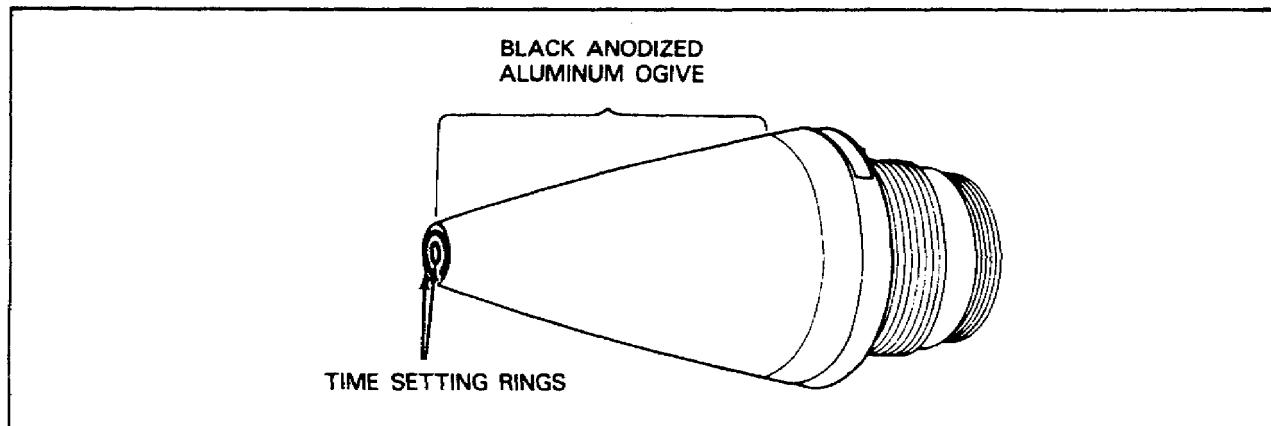


Figure 73. Electronic Time Fuze.

#### IDENTIFYING SMALL GUIDED MISSILES

A guided missile is a self-propelled projectile that can be controlled and guided in flight by various guidance systems. Small guided missiles are divided into two major types by purpose: antitank, which are surface-to-surface missiles used against armored vehicles and other armored targets, and air defense, which are surface-to-air missiles used against low- to medium-altitude aircraft.

#### Antitank Guided Missiles (ATGM)

Three antitank guided missiles will be covered in this subcourse: the Shillelagh, the Dragon, and the TOW.

**Shillelagh.** The Shillelagh, named after an Irish war club, is an antitank guided missile fired from the 152mm gun tube on the M60A2 tank or from the Sheridan armored reconnaissance vehicle. See Figure 74. It uses an optical infrared data link guidance system. This means that both the missile and launcher have infrared receivers

and sources. When the missile is in flight, it receives an infrared beam from the vehicle and feeds another infrared beam back to the launcher. The control receiver converts infrared signals to electronic energy that opens and closes valves in the exhaust, steering the missile in flight. The warhead is a high-explosive shaped charge.

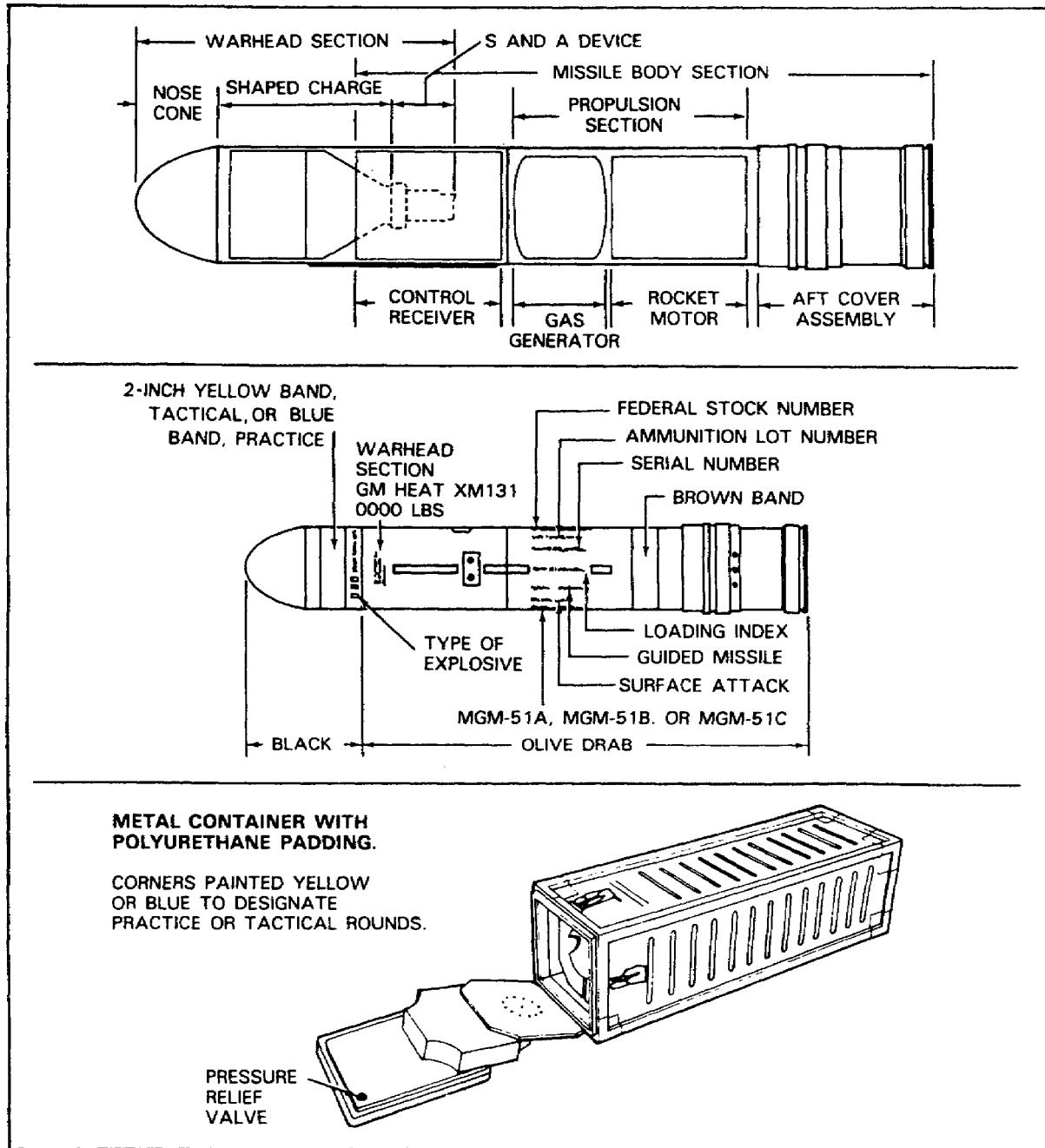


Figure 74. Shillelagh ATGM.

The Shillelagh ATGM is 45 inches long, 6 inches in diameter, and weighs 60 pounds. It is issued in an airtight metal container.

**Dragon.** The Dragon (Figure 75) is a short-range medium antitank and assault weapon. A complete round consists of a disposable fiberglass launcher containing a missile. It is shoulder fired. The tracker and sight assembly is carried by the gunner and can be reused. The missile can not be removed from its launch tube.

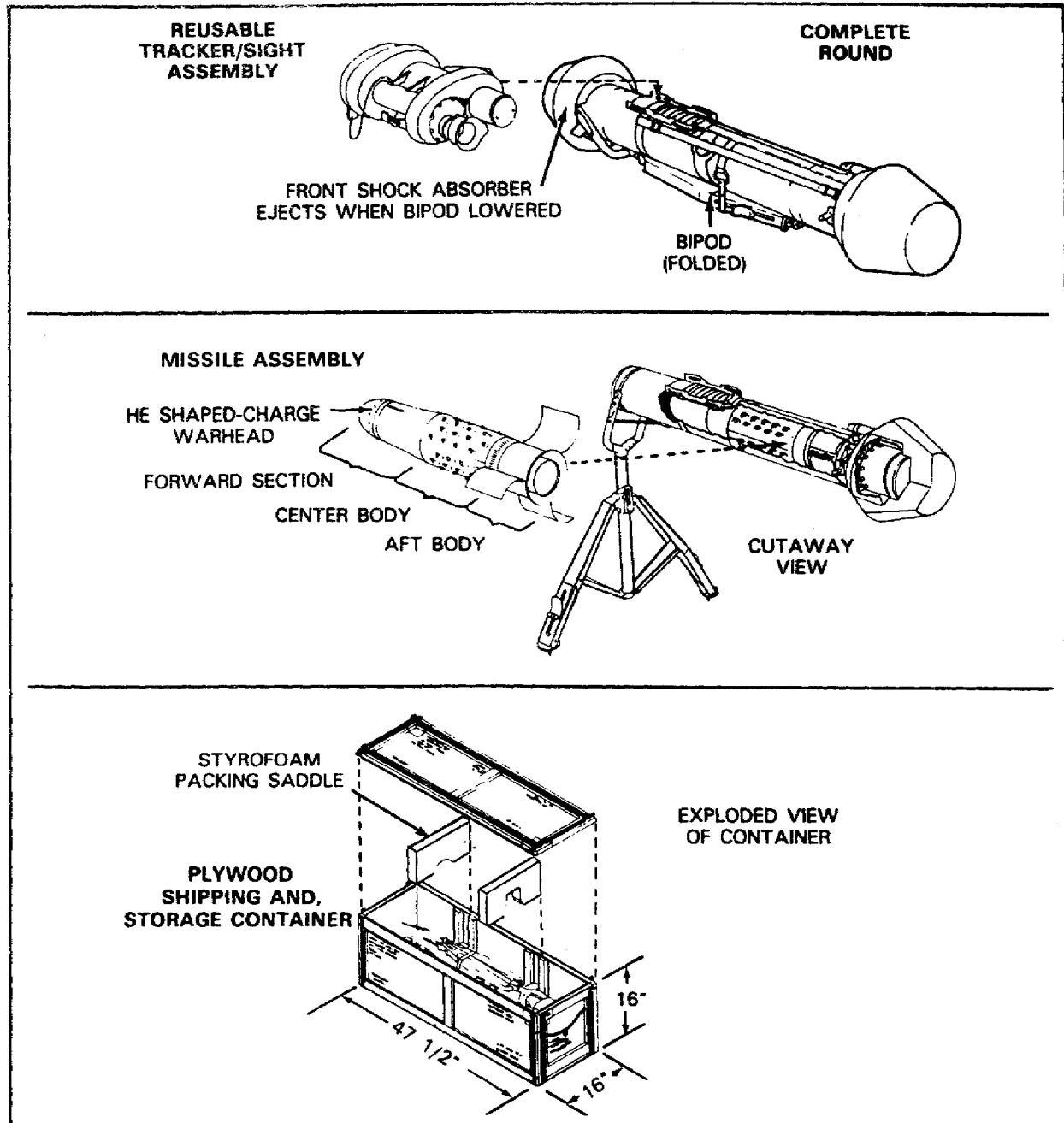


Figure 75. Dragon ATGM Weapon.

The guidance system of the Dragon uses an infrared beam and a spool of wire. The wire is unwound from the missile while it is in flight. It maintains electrical contact between the tracker and the missile. Movement of the tracker sends electronic signals through the wire to ignite side-thrusting rocket motors that steer the missile. The color code and markings of the Dragon ATGM weapon are shown in Figure 76.

**TOW.** The TOW (tube-launched, optically-tracked, wire-guided missile) is a heavy antitank and assault weapon with a range of approximately 3,000 meters. See Figure 77. Like the Dragon, a complete TOW round consists of a missile sealed inside a disposable launch tube. The rest of the launching system

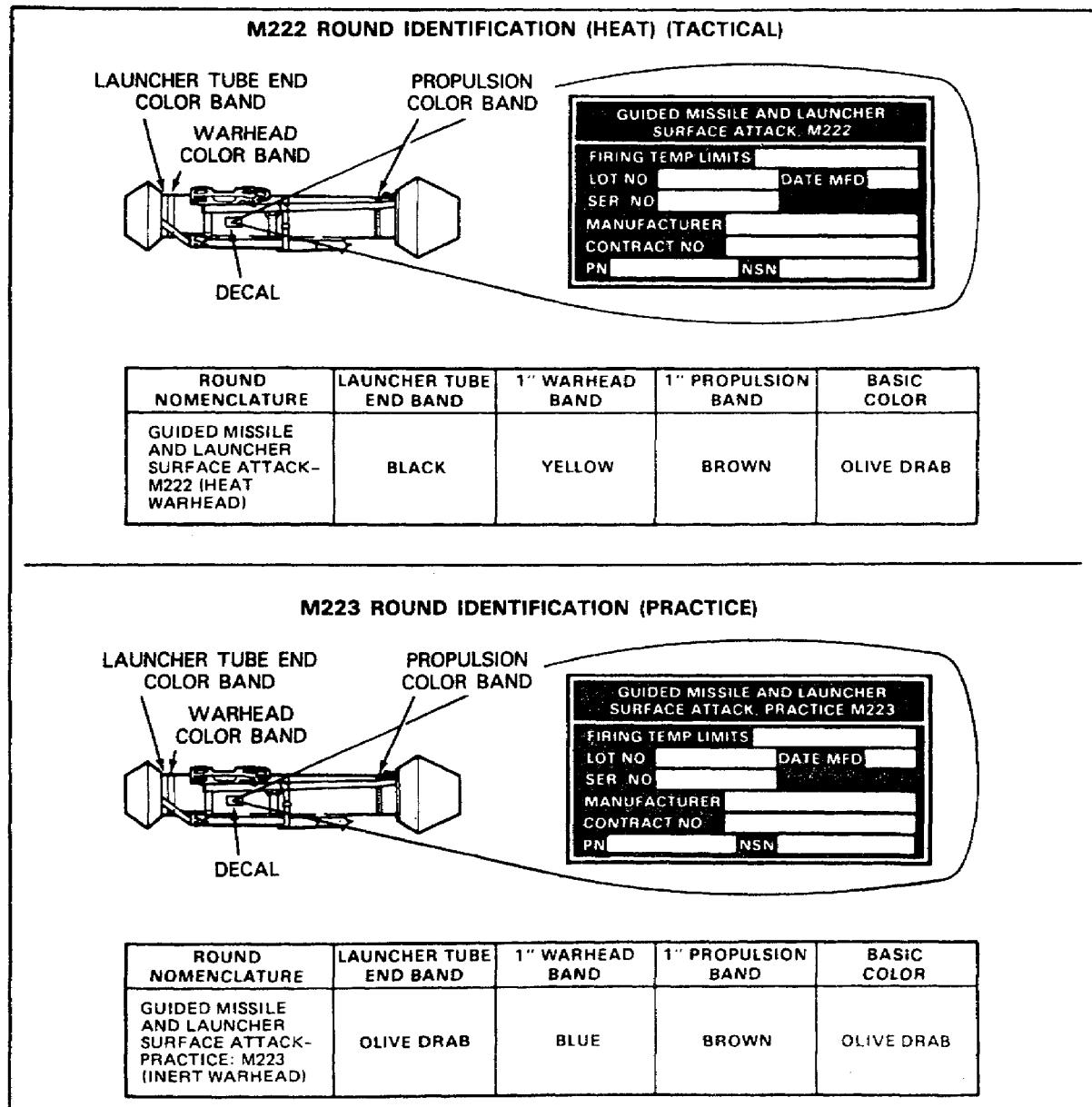
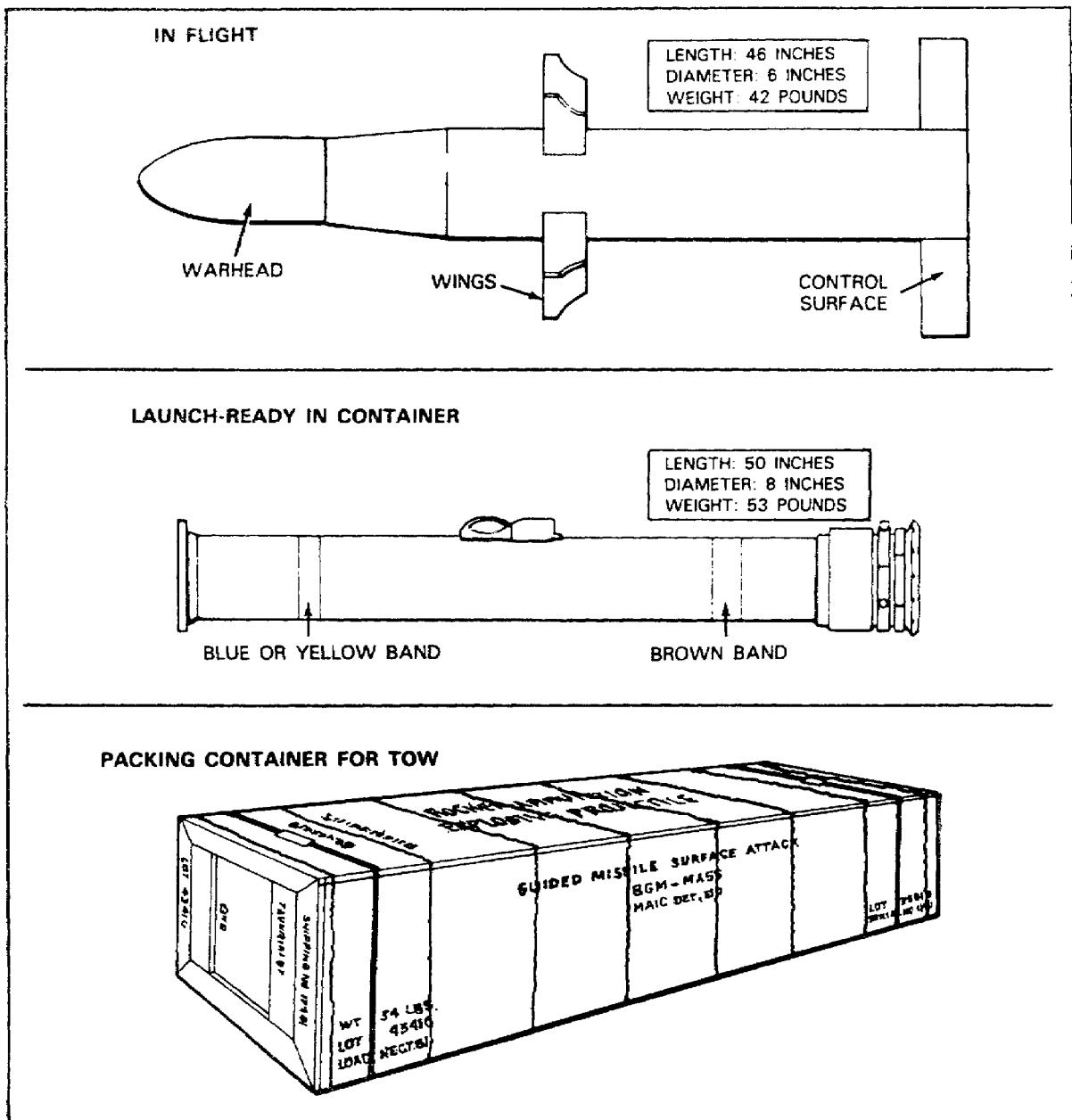


Figure 76. Color Code and Marking of the Dragon ATGM Weapon.

is reusable. The TOW can be fired from a tripod, a jeep, an armored vehicle, or a helicopter.

The TOW is guided by an infrared beam and two wires, dispensed from two spools in the missile, that maintain electronic contact with the launcher. Movement of the optical tracker sends electronic signals through the wires, moving the control surfaces that steer the missile in flight. The container for the TOW is a wire-bound box with styrofoam packing saddles inside it.



*Figure 77. TOW ATGM Weapon.*

## Air Defense Guided Missiles

Three air defense guided missiles will be covered in this subcourse: the Chaparral, the Redeye, and the Stinger.

**Chaparral.** The Chaparral (Figure 78) is an air defense guided missile used in forward areas for defense against low- and medium-altitude aircraft. It is fired from a tracked vehicle or from a ground mount.

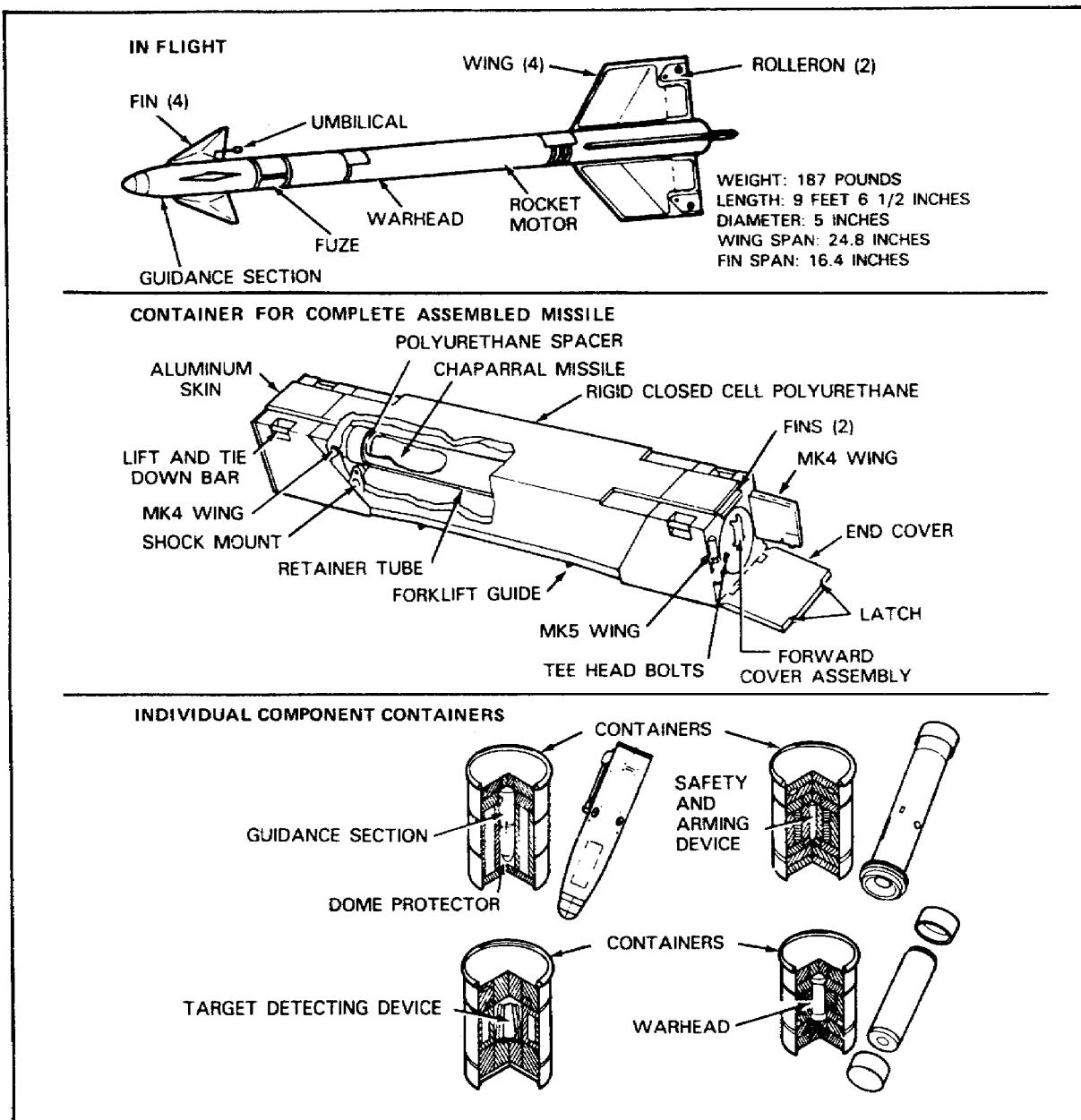


Figure 78. Chaparral Air Defense Guided Missile.

The Chaparral is guided by an infrared seeker in its nose end. The seeker locks on the heat of an aircraft. Movement of the aircraft is sensed by the seeker, and forward fins move to steer the missile to the aircraft.

The Chaparral missile comes either in a polyurethane container or as separate components in metal drums. The container for the complete round is 10 feet long, 18 inches high, and 18 inches wide. Its weight, with the missile, is 300 pounds.

**Redeye.** The Redeye (Figure 79) is a lightweight air defense guided missile. It is used by forward area troops for defense against low-flying aircraft. It is shoulder-launched from a disposable fiberglass launcher.

The Redeye uses an infrared homing guidance system similar to that of the Chaparral. The complete round consists of a missile sealed inside the launcher. The entire assembly is 50 inches long and weighs 30 pounds.

The Redeye is issued in either an airtight aluminum container with foam rubber padding or a polystyrene container with the round sealed in a plastic barrier bag. Both containers contain one missile in the launcher and three battery/gas units that provide power and cooling for firing. The weight of the aluminum container including contents is 72 pounds. The weight of the polystyrene container including contents is 50 pounds.

**Stinger.** The Stinger is similar to the Redeye, and will eventually replace it in the field. The Stinger is also a lightweight weapon fired from a disposable launcher. It is also shoulder-fired and used against

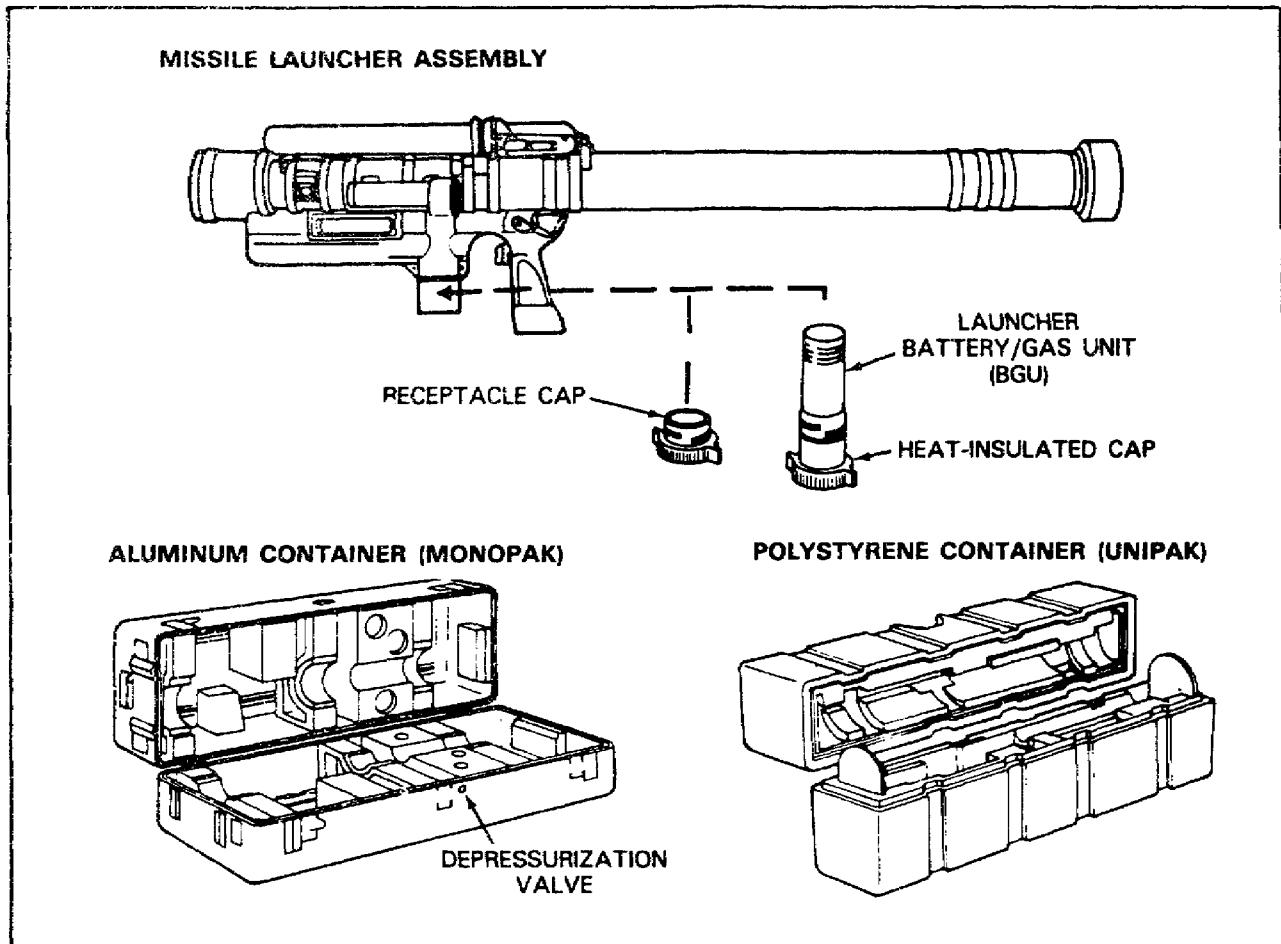


Figure 79. Redeye Air Defense Guided Missile.

low-flying aircraft. The Stinger, however, is a great improvement over the Redeye. It has a longer range, an improved guidance system, a larger warhead, a reusable gripstock assembly, and an IFF (identification friend or foe) system that can identify aircraft as enemy or friendly.

The Stinger is issued in two different configurations, the weapon-round and the missile-round. See Figure 80. The weapon-round is a round complete with gripstock, IFF antenna, and three battery/gas units packed in a metal container. The weight of the container with contents is 86.8 pounds. The missile-round is the missile in the launch tube only, packed with three battery/gas units in a cardboard box within a plastic barrier bag packed in a wire-bound wooden box. The weight of the container with contents is 73.6 pounds.

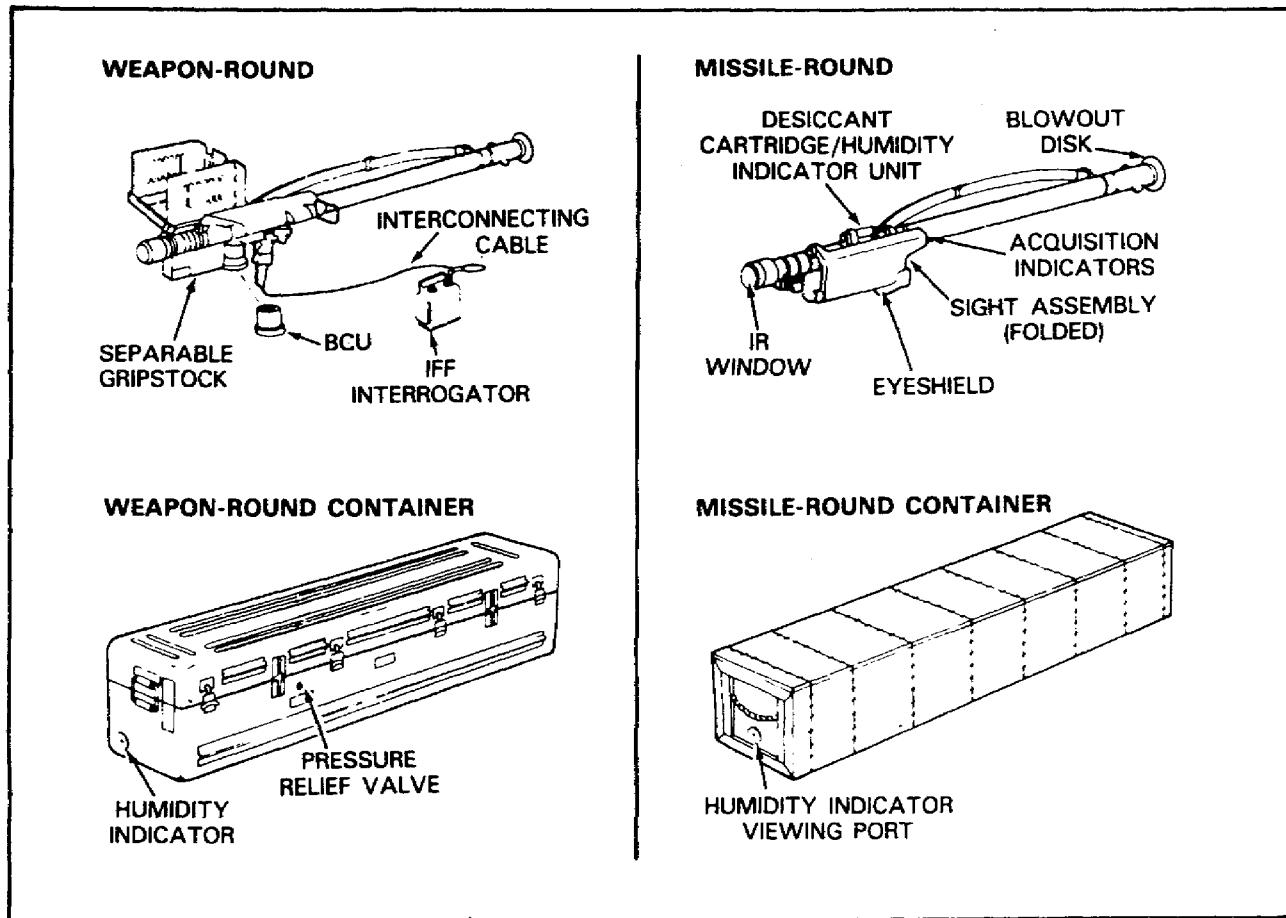


Figure 80. Stinger Air Defense Guided Missile.

#### IDENTIFYING DEMOLITION MATERIALS

The term "demolition materials" covers a variety of explosive charges and related equipment. It also includes initiating devices and nonexplosive equipment. Demolition materials have many different uses, including the destruction of equipment, dams, bridges, and railroads; excavating; construction projects; mining; and booby-trapping.

Demolition materials may be classified according to filler, use, and type like other ammunition items; but here they will be classified as demolition charges, priming and initiating materials, and demolition kits.

## Demolition Charges

Demolition charges are high-explosives of various sizes, shapes, and composition. Those discussed here are the ones most frequently found in ammunition stocks.

**Trinitrotoluene (TNT).** Trinitrotoluene is one of the most powerful military explosives. TNT blocks are excellent for use in cutting and breaching operations. They are issued in 1/4-pound, 1/2-pound, and 1-pound blocks. See Figure 81.

The cylindrical 1/4-pound block measures about 1 1/2 inches in diameter and is about 4 inches long. The rectangular 1/2-pound and 1-pound blocks are both 2 inches square on the ends, but the 1/2-pound block is 3 1/2 inches long and the 1-pound block is 7 inches long. Except for the ends, all three TNT blocks are covered with cardboard. Both ends of all three blocks are covered with metal. One of the metal ends on each block has a threaded cap well in it.

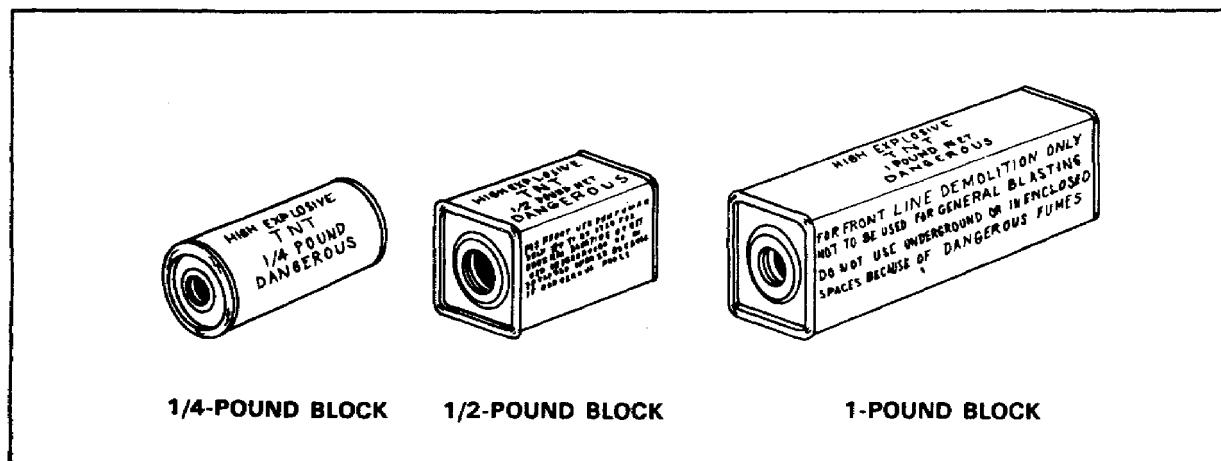


Figure 81. TNT Blocks.

**Charge Demolition Assembly, M37.** See Figure 82. The charge, demolition block, M5A1 is made of 2 1/2 pounds of composition C-4 encased in a plastic container. It is olive drab with yellow markings and has a threaded cap well in each end. Composition C-4 is a plastic explosive. It may be removed from the container and molded like putty to any shape desired. This makes it good for cutting steel and for most combat demolition operations. There are 8 M5A1 blocks per assembly and two assemblies packed to a wooden box. The M5A1 block is also issued packed 24 blocks to a wooden box.

**Charge Demolition Assembly, M183.** See Figure 83. The charge, demolition block, M112 consists of 1 1/4 pounds of composition C-4 in a mylar-film bag. The bag is olive drab with yellow markings and has pressure-sensitive adhesive tape on one surface for quick placement. The explosive can be removed from the bag and hand formed to any shape desired. This charge is ideal as a cutting charge and for other combat demolitions. There are 16 M112 blocks per assembly and two assemblies packed to a wooden box. The M112 block is also issued packed 30 charges to a wire-bound wooden box.

**Charge, Demolition Block, M118.** The charge M118 (Figure 84) consists of four 1/2-pound sheets of flexible explosive commonly known as Flex-X. Each sheet is about 3 inches wide, 12 inches long, and 1/4 inch thick. It has pressure-sensitive adhesive tape attached to one surface, making it ideal as a cutting charge. The four sheets are enclosed in a mylar-film bag, which is olive drab with yellow markings. The M118 block is packed 20 blocks with 80 metal blasting-cap holders to a wooden box.

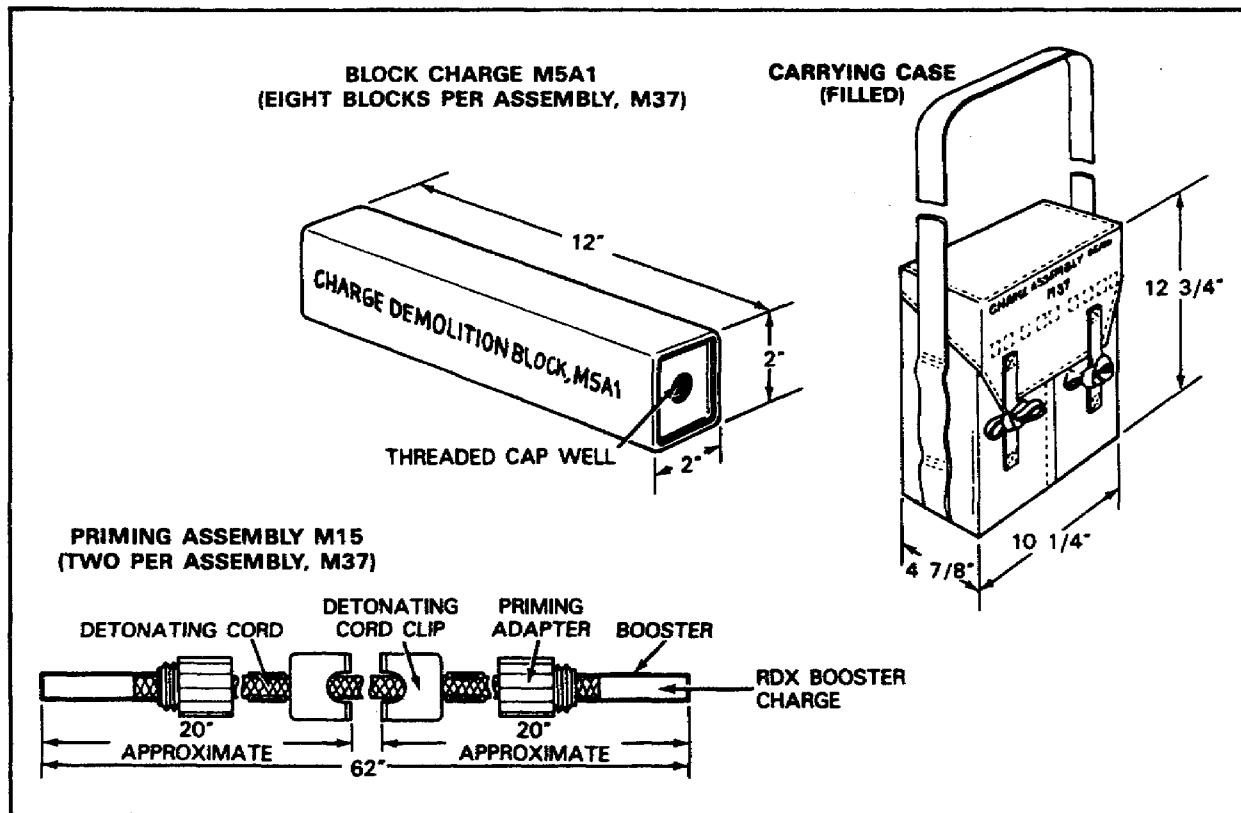


Figure 82. Charge Demolition Assembly, M37.

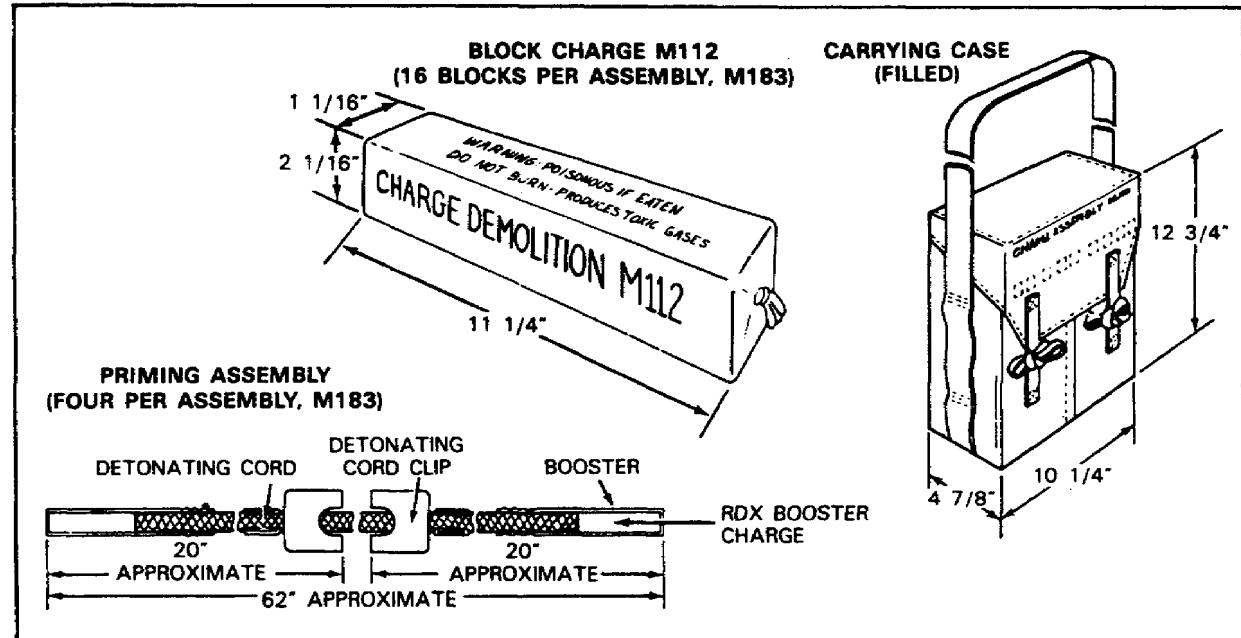


Figure 83. Charge Demolition Assembly, M183.

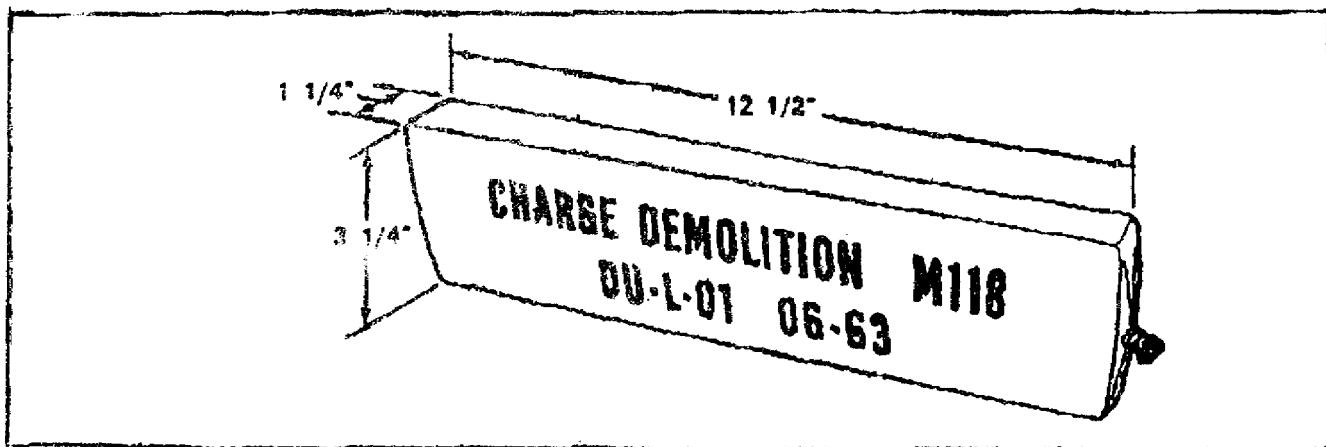


Figure 84. Charge, Demolition Block, M118.

**Charge, Demolition Roll, M186.** The demolition roll charge (Figure 85) is made of the same flexible explosive as the M118 flexible sheets, and it is used for the same purposes. In its roll form, there are 50 feet of Flex-X on a plastic spool. The spool is olive drab with yellow markings. The roll is packed one roll with 15 blasting-cap holders to a canvas bag, with three bags per wire-bound wooden box.

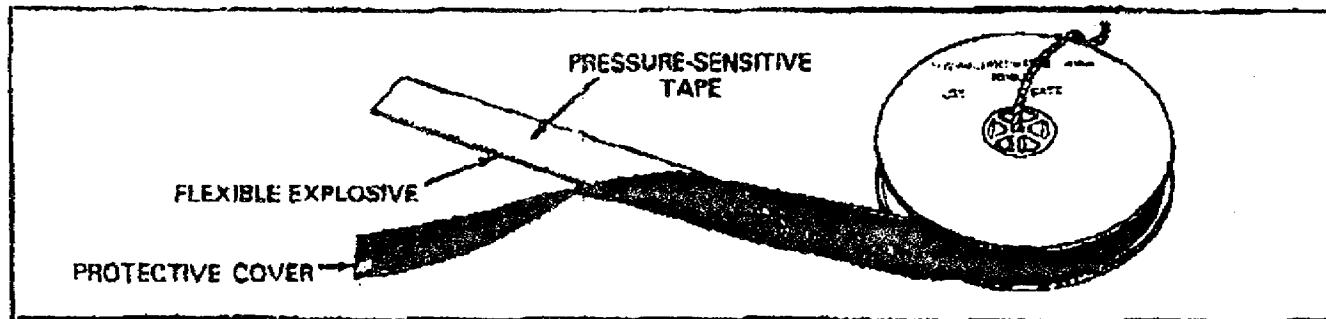


Figure 85. Charge, Demolition Roll, M186.

**Charge, Cratering, 43-Pound.** The 43-pound cratering charge (Figure 86) is used for cratering and ditching. Since it contains a large amount of explosive, it may also be used to destroy buildings and bridges. The charge consists of a cylindrical metal container filled with 30 pounds of ammonium nitrate and a 10-pound TNT booster charge. The complete charge weighs 43 pounds. It has a metal rings attached to its top and two priming tunnels on the side. The metal container is color coded olive drab with yellow markings. The charge is packed one per wooden box.

**Shaped Demolition Charges.** Shaped charges are used to penetrate or bore holes in earth, metal, masonry, concrete, or pavement. Note the cone-shaped cavity in the base of the charge in Figure 87. When the explosive is detonated, the force is focused into a narrow jet directly in line with the cone. Maximum penetrate is obtained when the charge is exploded at a specific distance from the target, called "standoff distance" or "standoff."

**Charge, Demolition, Shaped, M3, 40-Pound.** This shaped demolition charge (Figure 87) is approximately 30 inches high (including the metal standoff tripod) and 10 inches in diameter. It is color coded olive drab with yellow markings. It is packed one charge and one metal standoff frame to a wooden box.

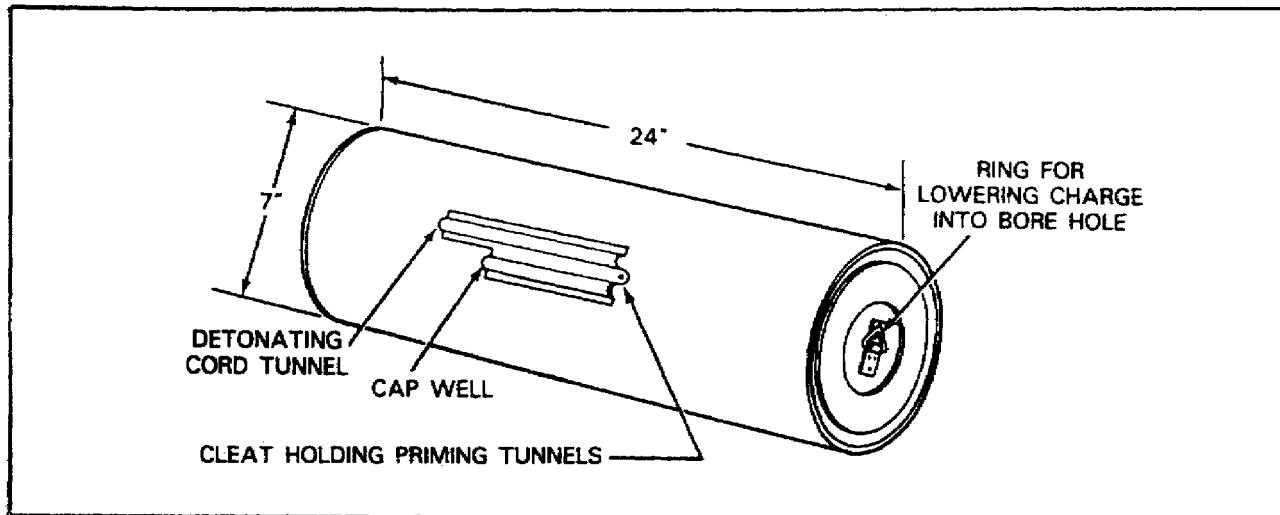


Figure 86. Charge, Cratering, 43-Pound.

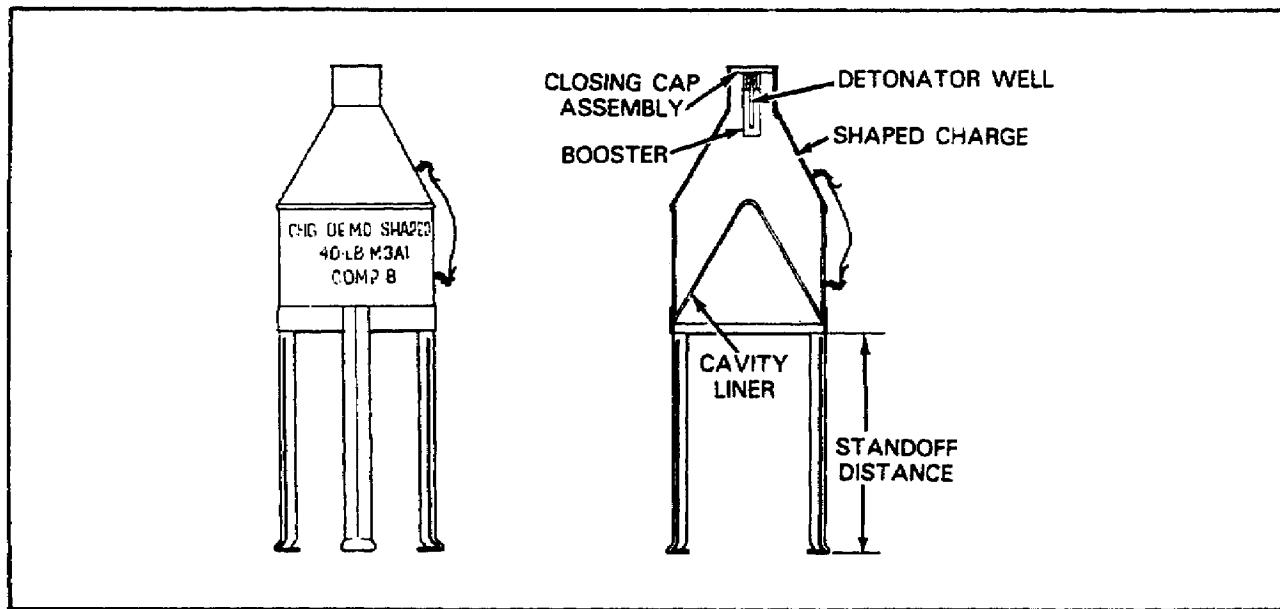


Figure 87. Charge, Demolition, Shaped, M3, 40-Pound.

**Charge, Demolition, Shaped, M2A3, 15-Pound.** This shaped demolition charge (Figure 88) functions the same way as the 40-pound shaped charge, but it is smaller. Specially designed for penetrating reinforced concrete, it is approximately 16 inches high and 7 inches in diameter and has a fiberboard sleeve for standoff. It is color coded olive drab with yellow markings, and is packed three to a wooden box.

**Dynamite, Military, M1.** Dynamite is used in the military for construction, quarrying, and ditching. Military dynamite differs from commercial dynamite in that it contains RDX and binder instead of nitroglycerine. RDX and binder filler is much safer to store, handle, and use. The military dynamite M1 stick (Figure 89) is approximately 8 inches long and 1 1/4 inches in diameter. Each stick contains approximately 1/2 pound of explosive and is packaged in paraffin-coated paper that is tan with black markings.

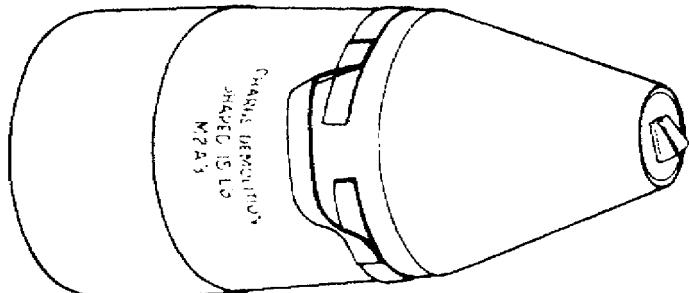


Figure 88. Charge, Demolition, Shaped, M2A3, 15-Pound.

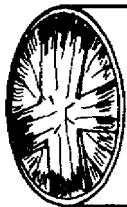


Figure 89. Dynamite, Military, M1.

### Priming and Initiating Materials

Priming and initiating materials are explosive and nonexplosive, electric and nonelectric equipment used to initiate demolition charges. The only priming and initiating materials covered in this subcourse are the explosive items found stocked in ammunition storage installations. Tools and equipment used in demolition operations are covered in another subcourse.

**Blasting Caps.** Blasting caps are the primary means of detonating demolition charges. They function like the fuze in an artillery projectile. Blasting caps contain a small amount of explosive that is very sensitive to heat and shock. They must be kept separated from other explosives until installed, and they must not be tampered with. Blasting caps are manufactured in two basic types, electric and nonelectric.

**Electric Blasting Cap.** The M6 electric blasting cap (Figure 90) is the most commonly used electric blasting cap in military demolition operations. It is used to set off high-explosives using a blasting machine or another source of electric power. The electric blasting cap consists of a small metal tube (less than 3 inches long and 1/4 inch in diameter) that contains the initiating explosive.

The ignition charge is ignited by heating the bridge wire. The ignition charge sets off the intermediate and base charges. These two charges detonate the main charge, where the blasting cap has been installed.

Two 12-foot lead wires extend from the tube. These wires are shorted together on the ends by a shunt that prevents accidental firing by static electricity. Blasting caps have no color coding or markings except on the packaging.

**Nonelectric Blasting Cap.** The M7 nonelectric blasting cap (Figure 91) looks like the electric blasting cap, but there are no lead wires on the M7 and one end is open. The nonelectric blasting cap is set off by a burning time fuse or by a detonating cord inserted in the open end of the blasting cap.

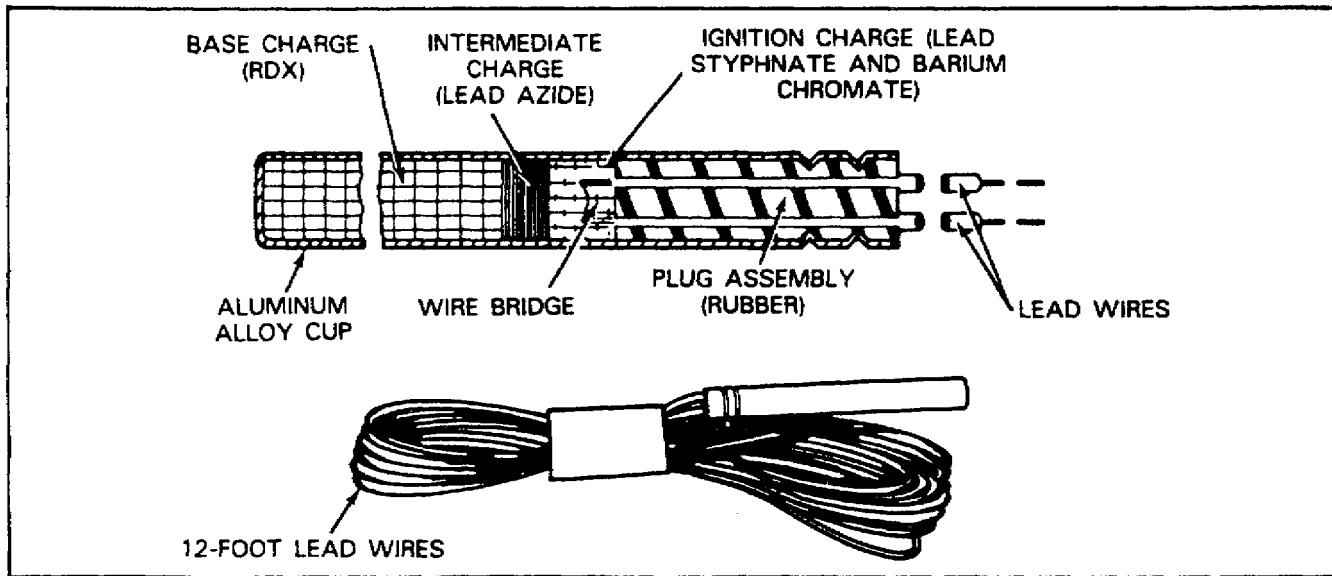


Figure 90. Cap, Blasting, Electric, M6.

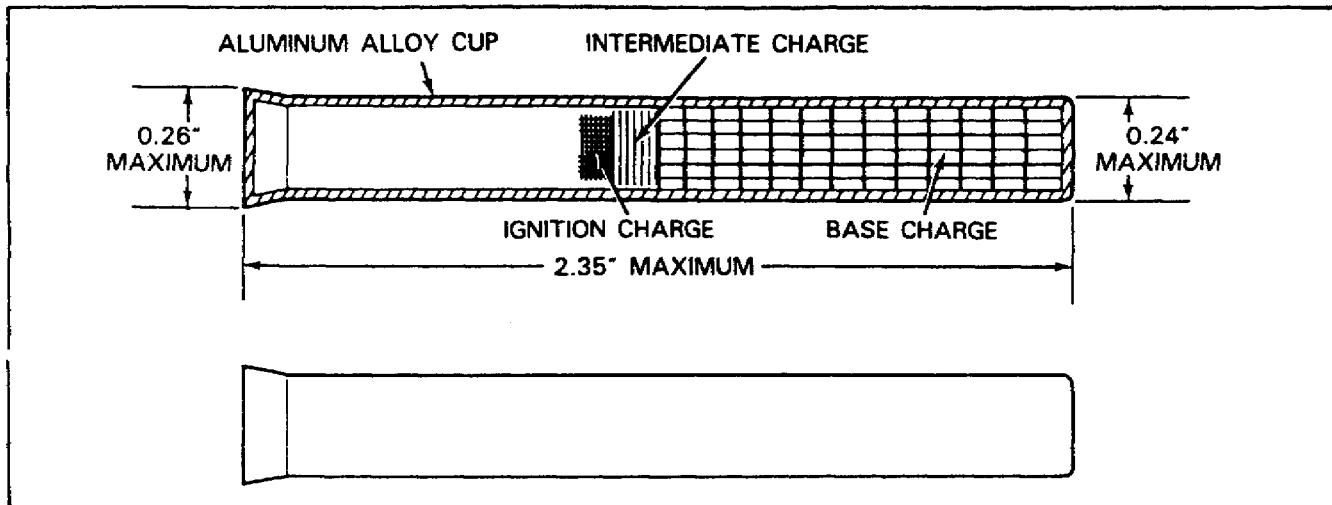


Figure 91. Cap, Blasting, Nonelectric, M7.

**Fuse, Blasting, Time.** Time blasting fuse is used to transmit a flame from an igniter to a nonelectric blasting cap. This gives the operator time to reach a safe distance or cover before detonation. Time fuse used by US forces is of two general types, safety fuse and time blasting fuse, M700.

**Safety Fuse.** Safety fuse (Figure 92) consists of a fiber cord with a core of black powder. The orange outer surface is waterproof. When the fuse is ignited, a flame travels through the black powder core at 30 to 45 seconds per foot. Safety fuse is issued in 50-foot rolls and packed in sealed metal cans in wooden boxes. There are 4,000 feet per wooden box. Safety fuse is identified by its orange exterior and black core.

**Fuse, Blasting, Time, M700.** This fuse (Figure 93) functions just like safety fuse; but it is covered with plastic, which provides better waterproofing, and its burning rate is more uniform (36 to 44 seconds per foot). It is color coded olive drab with a single yellow band every 18 inches and a double yellow band every 90 inches.

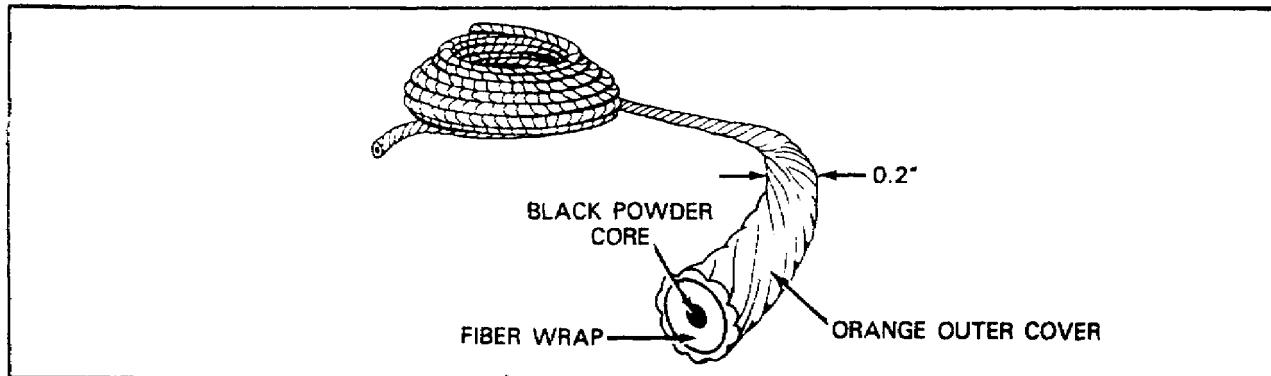


Figure 92. Fuse, Blasting, Time (Safety Fuse).

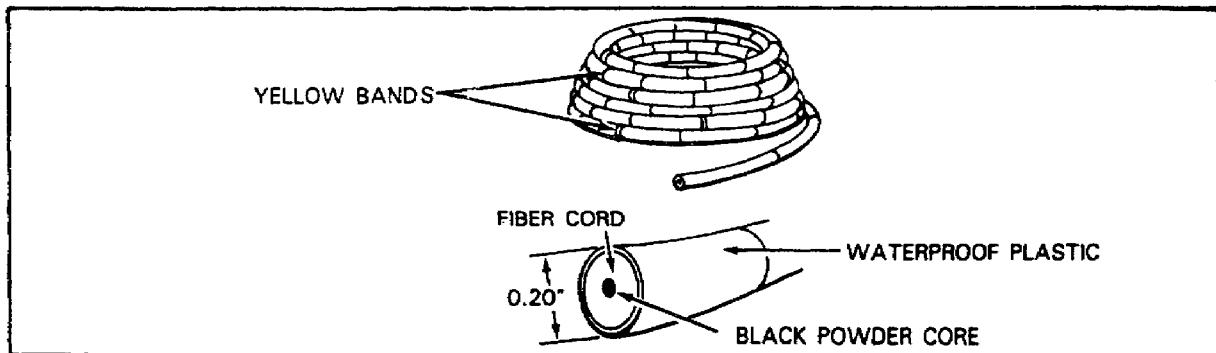


Figure 93. Fuse, Blasting, Time, M700.

**Detonating Cord.** Detonating cord (Figure 94) looks like time blasting fuse, M700, but it is very different. It has a high-explosive core that detonates when actuated by a blasting cap. It is used to detonate more than one charge at the same time. It is identified by its olive drab outer color and its white high-explosive core.

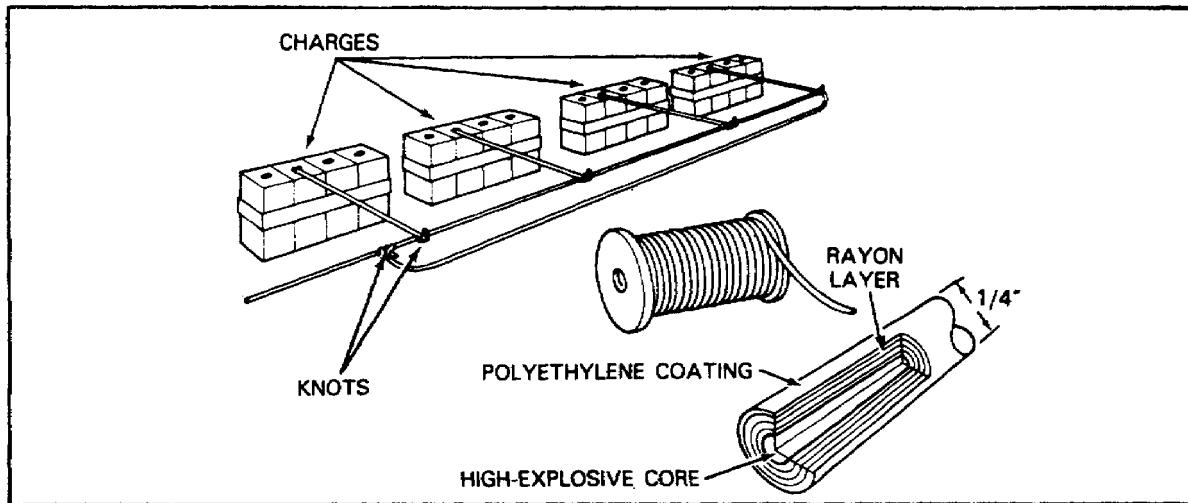


Figure 94. Detonating Cord.

**Igniter, Fuse, Weatherproof, M60.** The fuse igniter (Figure 95) is used to initiate time blasting fuse. It may be used in any weather, and even underwater. The igniter contains a firing mechanism with a pull ring, a fire pin, a spring, and a primer. It has a fuse holder on the forward end that provides a watertight seal when used to ignite time blasting fuse, M700. The fuse igniter M60 is 4 3/4 inches long and 3/4 inch in diameter. It is color coded olive drab with yellow markings.

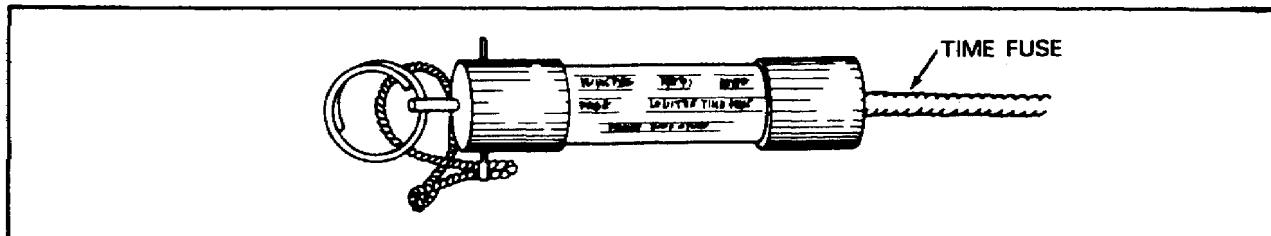


Figure 95. Igniter, Fuse, Weatherproof, M60.

**Demolition Firing Devices.** Another way to initiate explosive charges is to use various detonators and firing devices. These devices are used mostly for booby-trapping. They use pressure, pull, release, or a combination of these actions, such as pull-release, for initiation. Some examples of demolition firing devices are shown in Figure 96.

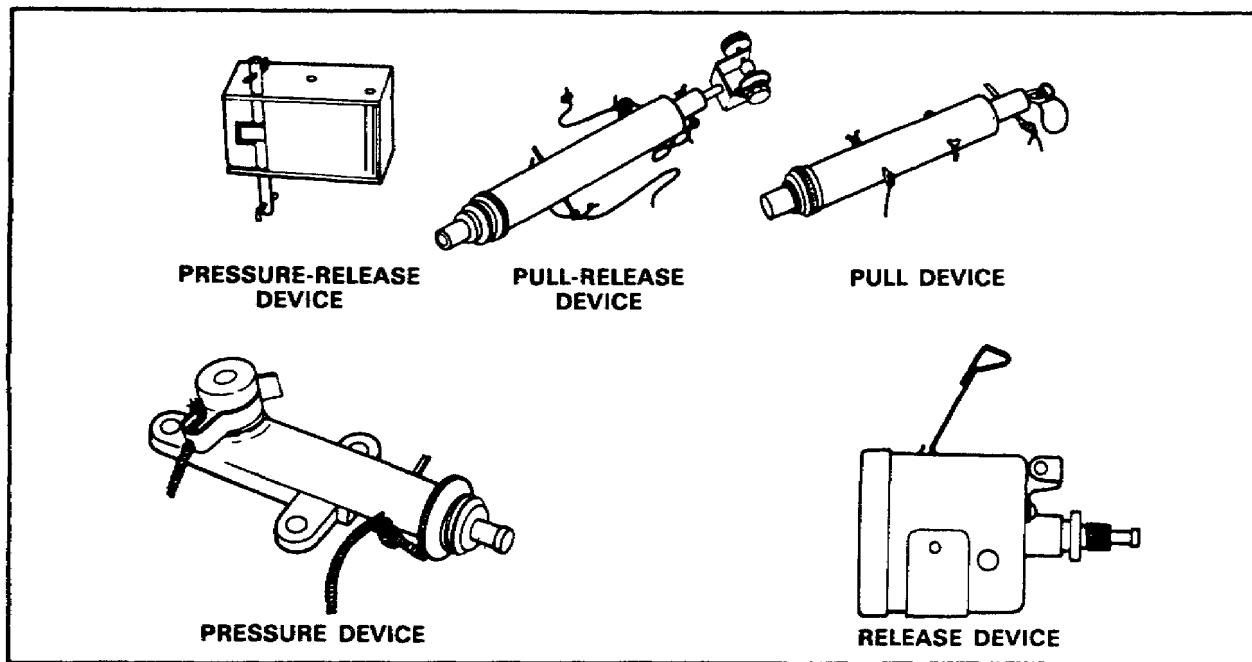


Figure 96. Demolition Firing Devices.

#### Demolition Kits

A demolition kit is an assortment of explosive and inert items packaged together to be used for a special demolition task. There are many types of demolition kits. Two of the most commonly used are demolition kit, cratering, M180, and demolition kit, projected charge, M173.

**Demolition Kit, Cratering, M180.** Demolition kit, M180 (Figure 97) greatly reduces the time and labor required in cratering operations. This kit digs a hole, places a charge in the hole, and detonates the charge, all almost simultaneously. The kit consists of a tripod with a 15-pound shaped charge at the base of one leg. The cratering charge is mounted above the shaped charge in the form of a warhead and a rocket motor. When the kit is set up and fired, the shaped charge blasts a hole in the ground. The rocket motor is ignited, propelling the warhead into the hole. Finally, the warhead is detonated, creating the crater-all within a fraction of a second.

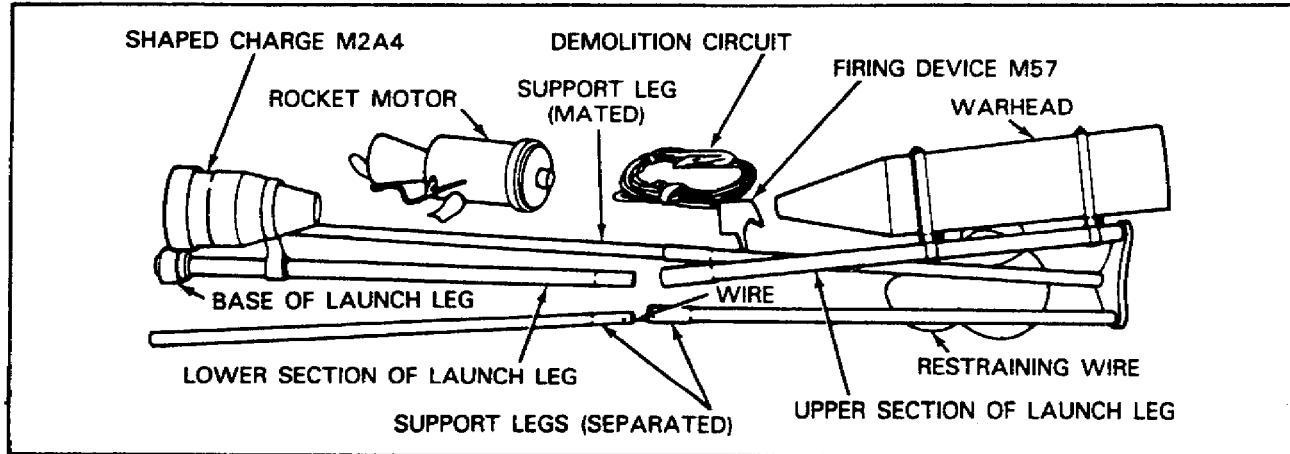


Figure 97. Demolition Kit, Cratering, M180.

**Demolition Kit, Projected Charge, M173.** Demolition kit, M173 (Figure 98) is an example of a mine-clearing device. It consists of a waterproof, boat-shaped skid or container 12 feet long, nearly 5 feet wide, and 2 feet high. Inside the container is a rocket motor and a 300-foot chain of C-4 explosive blocks connected by detonating cord. The whole unit is placed facing a minefield. The rocket motor is fired. As the rocket goes through the air, it pulls the explosive chain across the minefield. The explosives are then detonated, setting off all mines in the area and clearing a path through the minefield. The device is color coded olive drab with yellow markings.

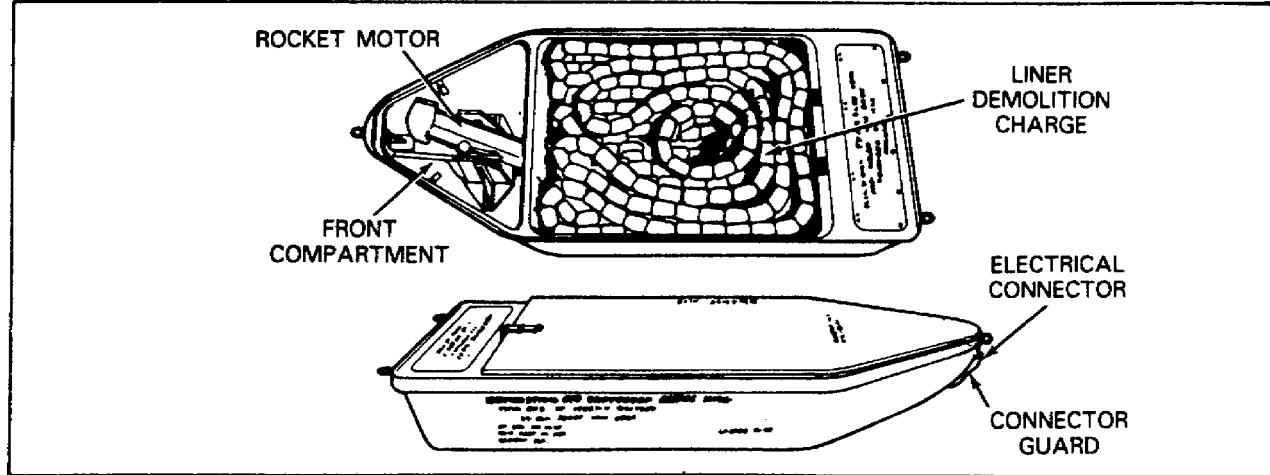


Figure 98. Demolition Kit, Projected Charge, M173.

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## IDENTIFYING PYROTECHNICS

Pyrotechnics are ammunition items used for illumination, signaling, or simulation of battle effects. Pyrotechnics can be launched or dropped from aircraft or used on the ground. Such pyrotechnics as illuminating artillery and mortar rounds, illumination grenades, and signaling smoke munitions have already been covered in this subcourse. Pyrotechnics are classified by their use.

### Illumination Pyrotechnics

**Photoflash Cartridges.** Photoflash cartridges (Figure 99) are used for night aerial photography. They are fired by an electric primer from an ejector mounted on an aircraft. A shorting clip prevents accidental firing before the photoflash cartridges are loaded in the aircraft ejector. When fired, the primer ignites a delay fuze and a propelling charge. The propelling charge expels the illuminating charge, which is ignited by the delay fuze one to six seconds after firing. When the illuminating charge is ignited, it makes a brilliant flash of up to 120,000,000 candlepower. Photoflash cartridges are unpainted aluminum with black markings.

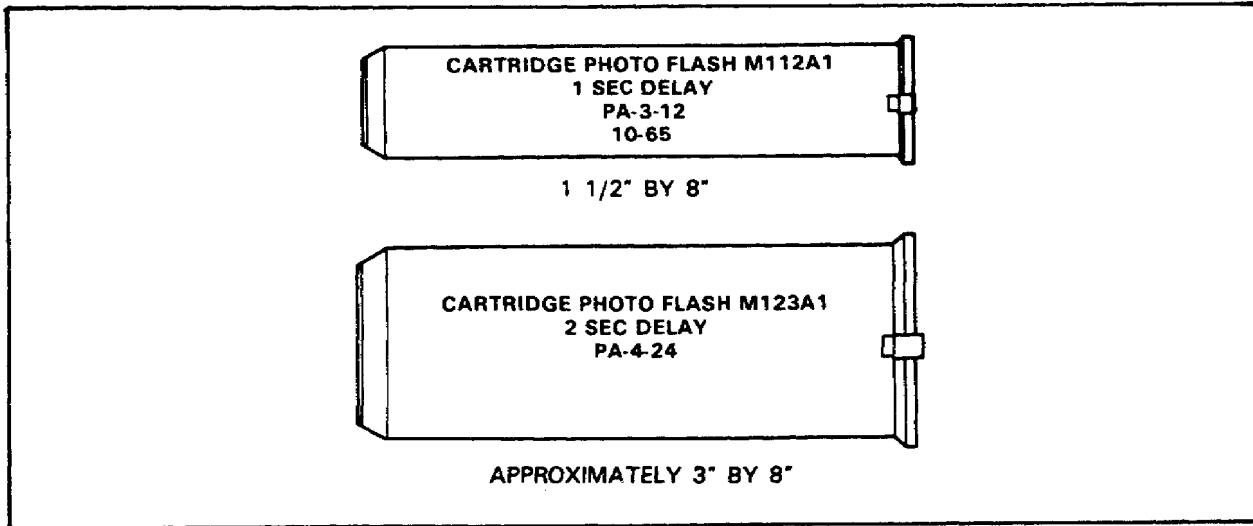


Figure 99. Photoflash Cartridges.

**Aircraft Parachute Flares.** Aircraft parachute flares (Figure 100) are launched or dropped from aircraft to provide illumination in support of tactical operations. They function like artillery and mortar illumination cartridges. A parachute and illuminating charge are ejected. The illuminant is ignited and descends by parachute. Aircraft parachute flares are unpainted aluminum with black markings.

**Ground Trip Flares.** The flare, surface, trip, M49A1 (Figure 101) is emplaced and rigged with a trip wire to give warning of infiltrating enemy troops. It does this by illuminating the field of the advancing enemy. The M49A1 flare is 5 inches long and 3 inches wide across the entire assembly. It is packaged with a trip wire spool and nails for emplacement. When activated by the trip wire, it provides a brilliant light at 2,000,000 candlepower for one minute. The M49A1 flare is easily identified by the mounting bracket safety clip and a safety lever similar to that on a hand grenade. It is color coded olive drab with black markings.

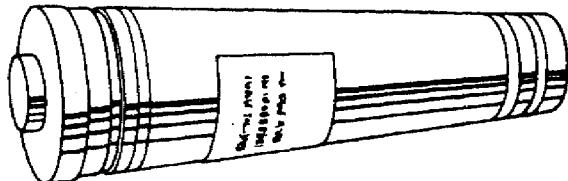


Figure 100. Aircraft Parachute Flare.

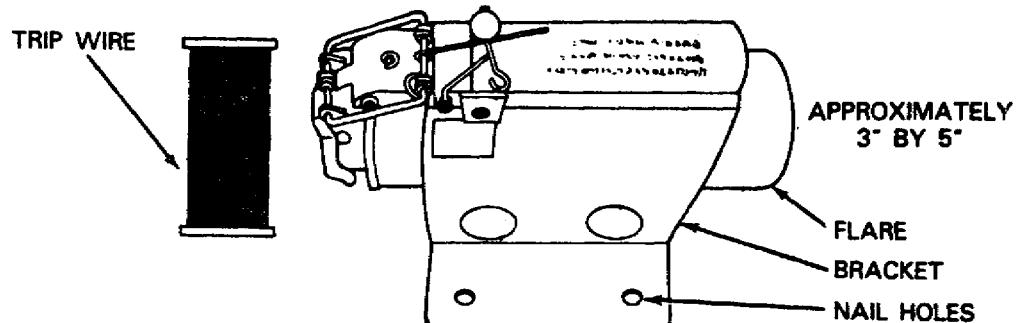


Figure 101. Flare, Surface, Trip, M49A1.

### Signaling Pyrotechnics

Signaling pyrotechnics are designed to produce light or smoke in various colors. Smoke is used for daytime operations. Light is used for nighttime or daytime operations. Light may be produced by parachute-supported or free-falling stars in singles or in clusters. The stars within clusters may be of different colors. See Figure 102 for the types of signal patterns used in aircraft and ground signals.

**Aircraft Signals.** Aircraft signals (Figure 103) are approximately 4 inches long and 1 1/2 inches in diameter. They resemble large shotgun shells. They have an aluminum case. Markings on the cartridges indicate the type and color of the signal produced. A band or bands of C's indicate that the signal has stars. The color of the bands of C's shows the color of the signal produced. The number of bands indicates the number of stars. For example, two bands of red C's indicate that the signal will make two red stars. A band of T's means that the signal has a tracer. The T's are in the same color as the color of the tracer flame produced. Other markings are in black. Aircraft signal flares are fired from a pyrotechnic pistol and may be used for ground-to-air or air-to-ground signaling.

**Ground Signals.** Ground signals are available in the same signal patterns as aircraft signals, but the markings are not color coded the same way. The color and type of signal are printed in black on an aluminum body. The signal shown in Figure 104 is approximately 10 inches long and 1 1/2 inches in diameter. It is self-contained and needs no launching system. A cap on the forward end holds a firing pin. The percussion primer is in the opposite end. To make the signal function, the cap with the firing pin is removed from the front end and placed over the back end, aligning the firing pin with the primer. The front end is then pointed upward, and the cap is hit sharply with the palm of the hand. This ignites a small rocket motor. The rocket motor propels the signal to an altitude of 650 to 700 feet. At this altitude, an expelling charge ejects and ignites the signal. The signal may be freefalling stars, parachute-supported stars, or colored smoke.

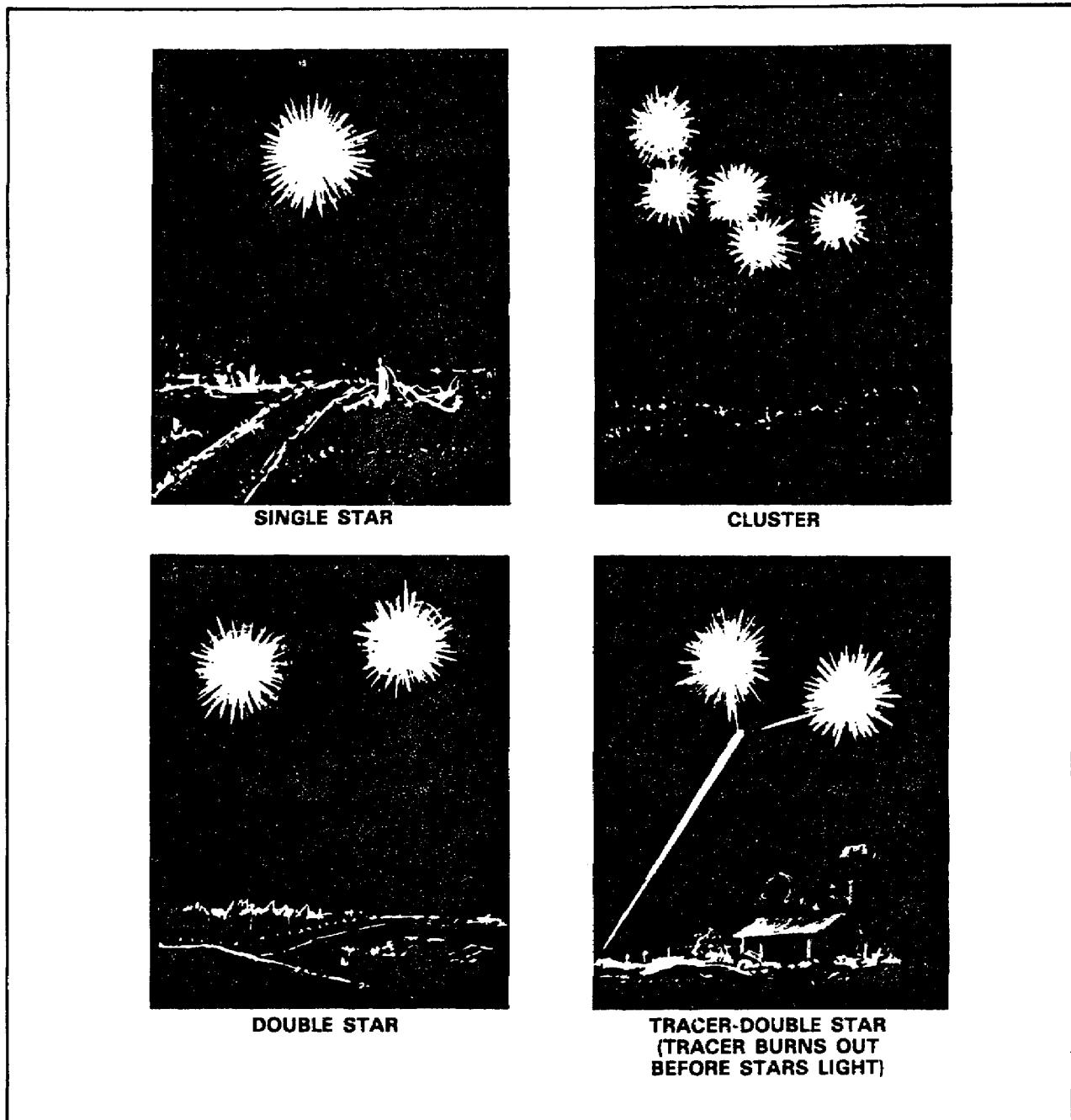


Figure 102. Aircraft and Ground Signal Patterns.

**Signal Kit, Personnel.** The signal kit, personnel (Figure 105) is also a hand-fired ground signal. It consists of a hand-held projector (launcher) and seven illumination signal cartridges. The projector is 4 inches long and approximately 1 1/2 inches in diameter. The signal cartridge is slightly longer than 2 inches. The base color of the signal cartridge is the same as the color of the signal produced. Signal cartridges are available in red, green, white, and amber. The projector fires the cartridge to an altitude of 360 feet, where it ignites. It burns for five seconds as it falls.

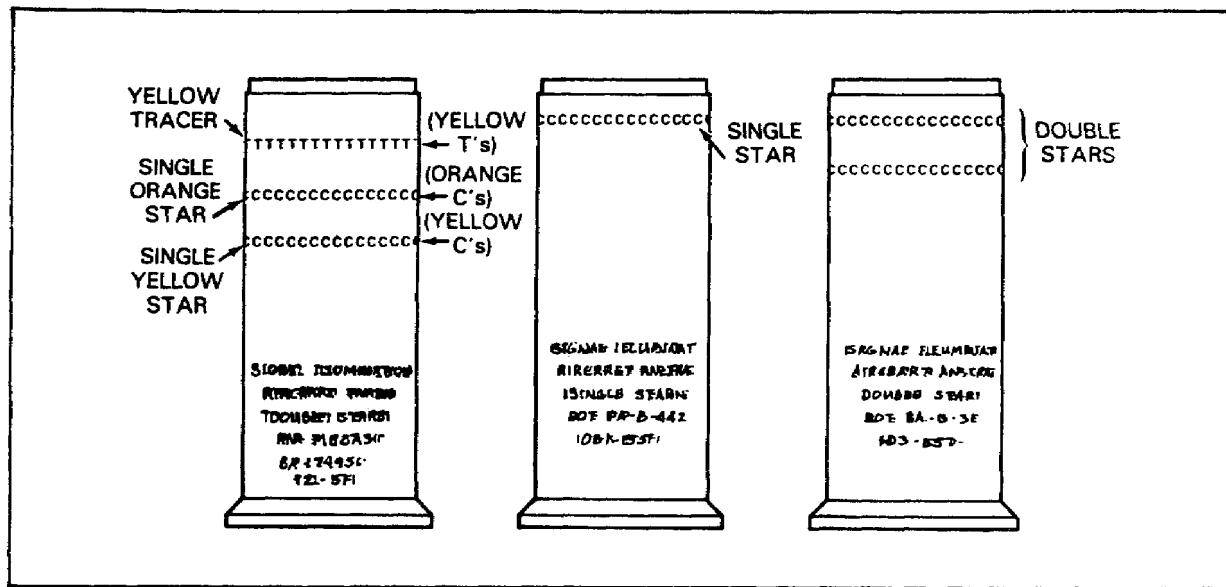


Figure 103. Aircraft Signals.

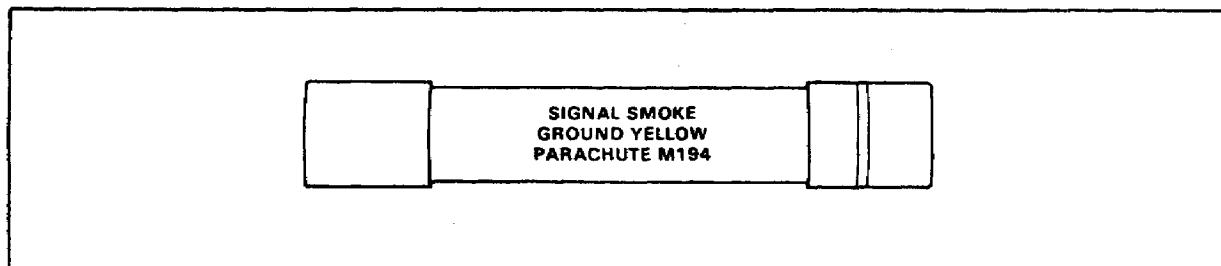


Figure 104. Ground Signal.

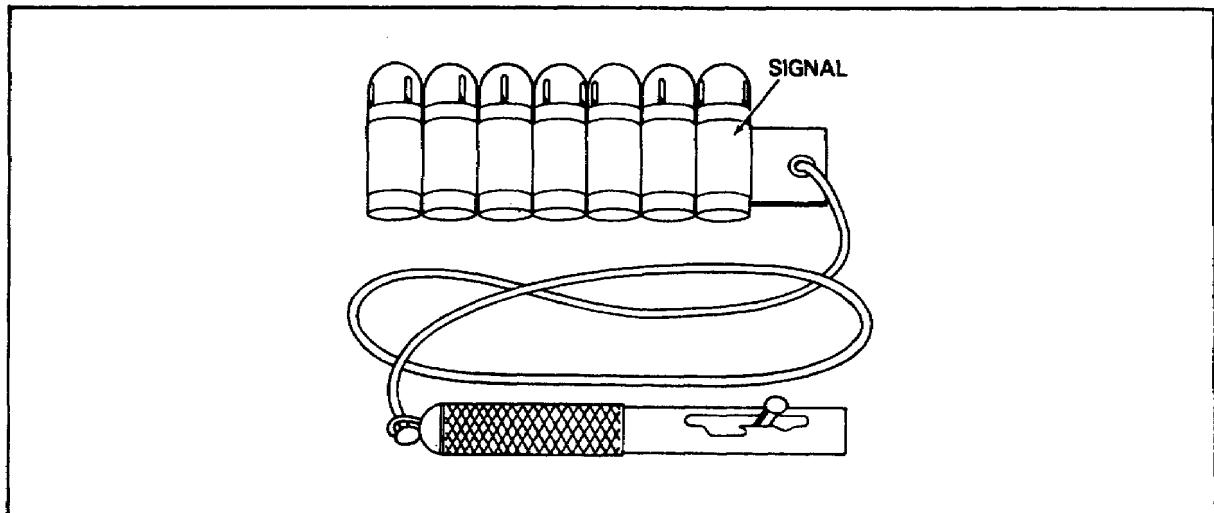


Figure 105. Signal Kit, Personnel.

## Simulator Pyrotechnics

Simulators are used to create the effect of specific items of ammunition.

**Detonation Simulator, M80.** The M80 detonation simulator (Figure 106) is simply a more powerful version of the common firecracker. It is used to simulate rifle or artillery fire or the detonation of grenades, booby traps, or mines. It is made of a paper cylinder containing three grams of flash composition. The cylinder has a fuse protruding from its side. The fuse may be ignited by a flame or by a firing device. The M80 detonation simulator is easily identified by its physical configuration and markings. The body is made of natural kraft paper, and the markings are black.

**Booby Trap Simulators.** Booby trap simulators are used to train troops in the installation, detection, and use of booby traps. These simulators are also used to instill caution in troops exposed to booby traps. Three different types of booby trap simulators are issued: flash, illuminating, and whistling. See Figure 107. Note that all three types are approximately the same size.

Booby trap simulators are packed with all the materials required for emplacement. The body of the simulator is made of white kraft paper. The markings are black.

**Simulator, Hand Grenade, M116.** The M116 hand grenade simulator (Figure 108) consists of a sealed paper cylinder slightly longer than 4 inches and slightly more than 2 inches in diameter. It contains a small charge of photoflash powder, and it has a short delay fuse and a fuse igniter. It is used to simulate battlefield noises and effects. The body is gray. It has a white label with black markings.

**Artillery Simulators.** There are several types of simulators designed to simulate the effects of various artillery projectiles. The two covered in this subcourse are the simulator flash, artillery, M110, and the simulator, projectile, groundburst, M115.

**Simulator, Flash, Artillery, M110.** In training, the simulator, flash, artillery, M110 (Figure 109) is used to simulate battle conditions. In forward combat areas, it is used as a decoy to make a flash similar to that of the 155mm howitzer projectile, HE. This simulator consists of an inner and an outer container. The inner container is filled with pyrotechnic compound. The outer container has a filler plug for filling with gasoline. The simulator is made of black plastic. It has a white label and black markings.

**Simulator, Projectile, Groundburst, M115.** The simulator, projectile, groundburst, M115 (Figure 110) is a paper cylinder approximately 7 inches long and 2 inches in diameter, filled with a photoflash charge. The simulator has a whistle assembly, a time delay (safety) fuse, and a fuse lighter assembly. It simulates the whistle, flash, and noise of explosion of incoming artillery. It functions in the same way as the hand grenade simulator. When the cap is removed from the fuse lighter and the cord is pulled, the fuse lighter ignites the fuse, allowing a 6-to 10-second delay before the fuse ignites the whistle assembly. The simulator makes a loud, shrill whistle for 2 to 4 seconds until the photoflash charge is ignited. When ignited, the photoflash charge explodes, producing a flash and a loud noise. This simulator is white, with a white label and black markings.

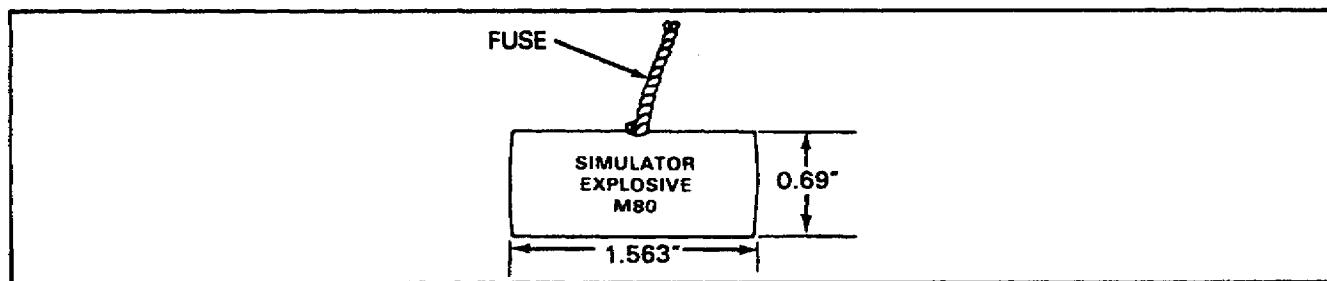


Figure 106. Detonation Simulator, M80.

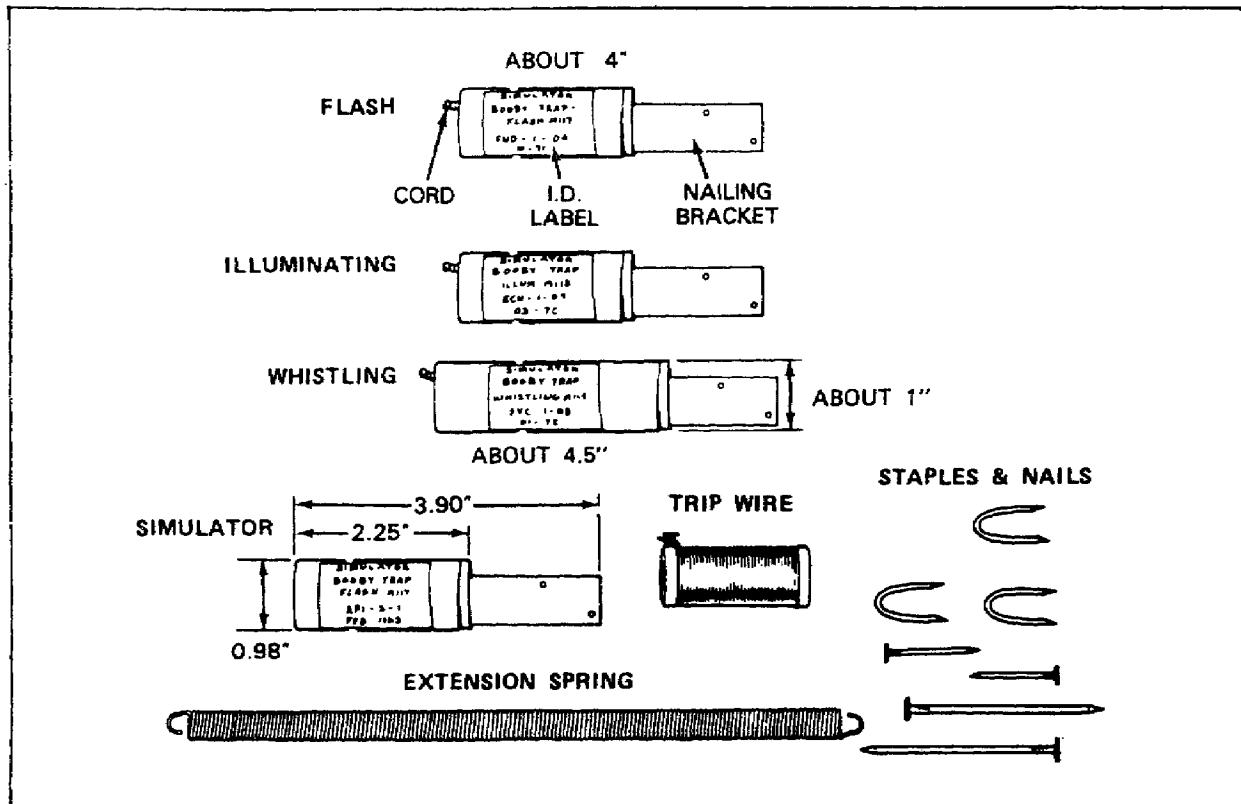


Figure 107. Booby Trap Simulators: Flash, Illuminating, and Whistling.

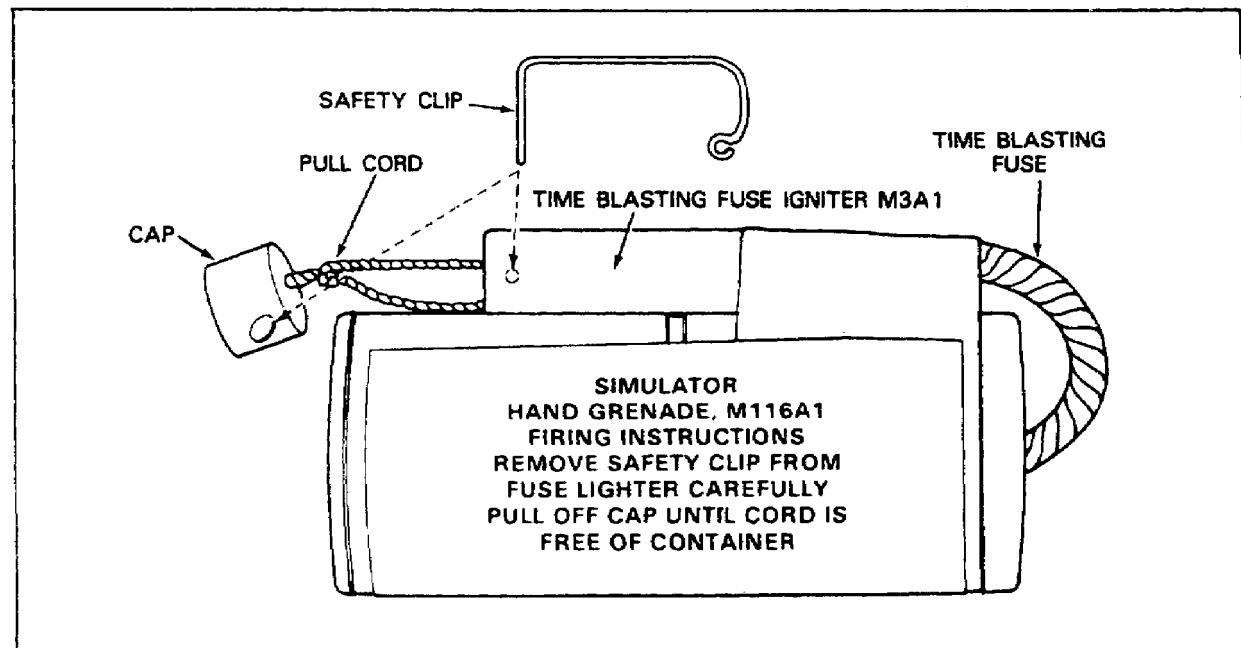


Figure 108. Simulator, Hand Grenade, M116.

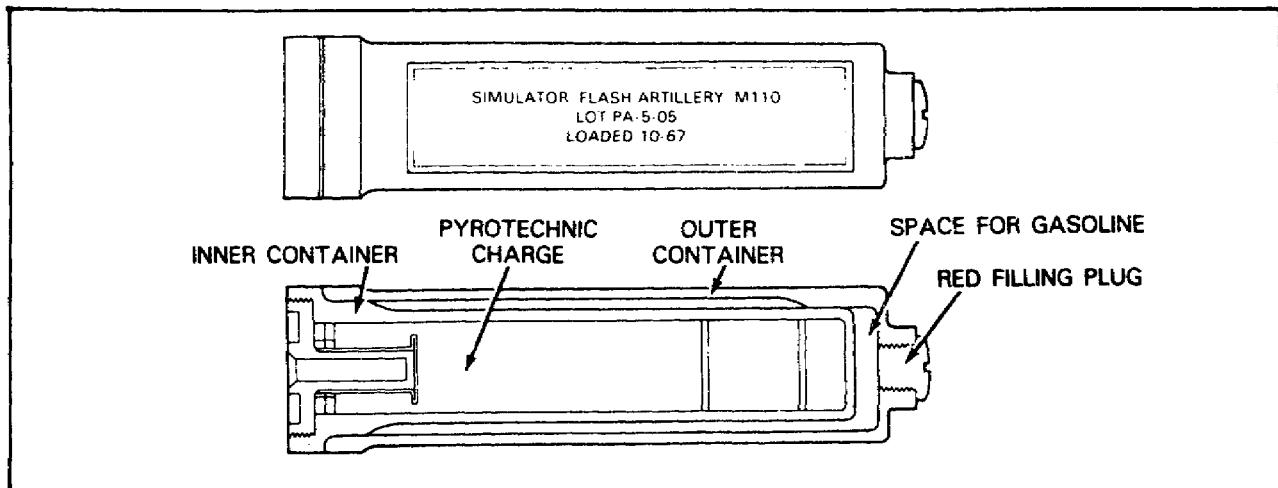


Figure 109. Simulator, Flash, Artillery, M110.

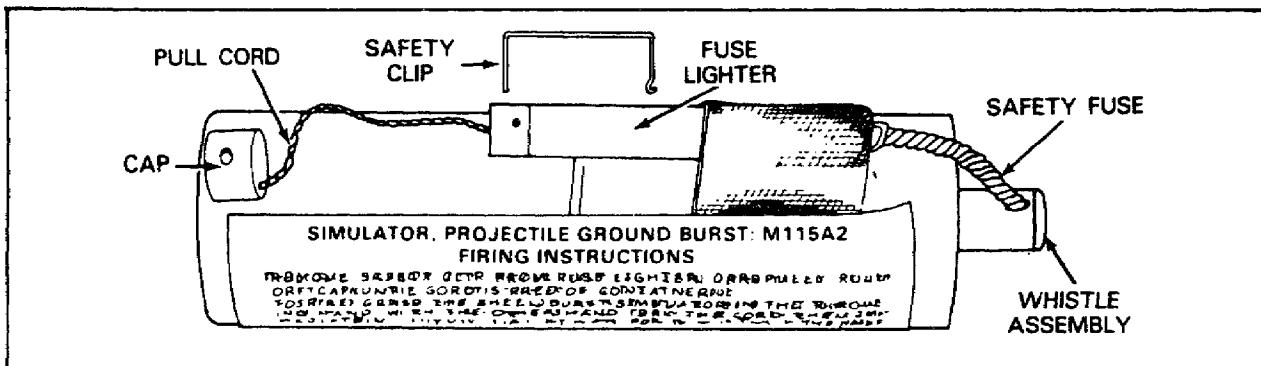


Figure 110. Simulator, Projectile, Groundburst, MI15.

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## REVIEW EXERCISES

Circle the letter of the correct answer to each question.

1. The small arms ball cartridge is easily identified by its:
  - a. Nickel finish.
  - b. Natural bronze finish.
  - c. Copper (red) finish.
  - d. Yellow finish.
2. Which of the following identifies .22 caliber ammunition?
  - a. 5.110 inches in diameter.
  - b. 3.085 inches in diameter.
  - c. .225 inch in diameter.
  - d. 2.80 inches in diameter.

3. A 7.62mm dummy cartridge is easily identified by:
  - a. Holes drilled in the cartridge case.
  - b. Elongated neck, lacquer seal.
  - c. Six grooves in the cartridge case, bullet diameter of approximately 1/3 inch.
  - d. Seven-petal crimp.
4. Identify the blank 105mm artillery cartridge by its description below.
  - a. A combustible cartridge case.
  - b. Elongated cartridge case.
  - c. The cartridge is approximately 6 inches long.
  - d. Aluminum cartridge case, white markings.
5. Identify the 60mm illuminating cartridge by its description below.
  - a. Elongated cylindrical shape, no gas check band.
  - b. Teardrop shape, obturating band.
  - c. Painted light-green with red markings.
  - d. The round is black with white markings.
6. The old 81mm training mortar cartridge is identified by its:
  - a. Bronze color and white markings.
  - b. Black color and white markings.
  - c. Bronze color and black markings.
  - d. Black color and yellow markings.
7. The old 81mm smoke-white phosphorous cartridge is identified by its:
  - a. White color and black markings.
  - b. Light-green color, red markings, and yellow band.
  - c. Gray color and yellow markings and band.
  - d. Gray color and white markings and band.
8. The subcaliber rocket used with the LAW 66mm system has the following dimensions:
  - a. 35 inches long and 1.37 inches in diameter.
  - b. 20 inches long and 2 inches in diameter.
  - c. 9 inches long and 1.37 inches in diameter.
  - d. 26 inches long and 1.37 inches in diameter.

9. Identify the color code of the 66mm incendiary rocket.
  - a. Gray with red bands and brown rocket motor.
  - b. Gray with red and yellow bands and brown rocket motor.
  - c. Light-red with a black band and brown rocket motor.
  - d. Light-red with a yellow band and brown rocket motor.
10. Identify the color code of the offensive hand grenade.
  - a. Black with yellow markings.
  - b. Olive drab with yellow markings.
  - c. Olive drab with red markings.
  - d. Black with red markings.
11. Identify the color code of the grenade, hand, incendiary, AN-M14.
  - a. White with black markings.
  - b. Light-green with black markings.
  - c. Gray with black markings.
  - d. Light-red with black markings.
12. Identify the color code of the M14 antipersonnel mine.
  - a. Olive drab with white markings.
  - b. Olive drab with black and yellow markings.
  - c. Olive drab with black markings.
  - d. Olive drab with yellow markings.
13. Which of the following identifies the M16 antipersonnel mine?
  - a. Square body, nonmetallic.
  - b. Approximately 8 inches in diameter.
  - c. Cylindrical metal body, olive drab with white markings.
  - d. Tin-can shape, lightweight metal body.
14. Which of the following identifies the mine, antitank, HE, heavy, M15?
  - a. Steel cylindrical body, 13 inches in diameter and 5 inches high.
  - b. Steel cylindrical body, 9 inches in diameter and 5 inches high.
  - c. Steel cylindrical body, 13 inches in diameter and 3 inches high.
  - d. Steel cylindrical body, 5 inches in diameter and 9 inches high.

15. Which of the following fuzes can be identified by its bore riding pin?
  - a. MT fuze.
  - b. MTSQ fuze.
  - c. VT fuze.
  - d. Mortar PD fuze.
16. How can safety fuse be identified?
  - a. It is olive drab and has a black band every 18 inches.
  - b. It has a black exterior and a white core.
  - c. It has an olive drab exterior and a white core.
  - d. It has an orange exterior and a black core.
17. How can detonating cord be identified?
  - a. It has a white exterior and a black powder core.
  - b. It has a white or olive drab exterior and a white core.
  - c. It has an orange exterior and a black powder core.
  - d. It has an orange exterior and a white core.
18. What is the color code of the Dragon ATGM, M222, tactical HEAT missile?
  - a. Olive drab with one blue band and one brown band.
  - b. Olive drab with one black band, one yellow band, and one brown band.
  - c. Olive drab with one black band and one red band.
  - d. Blue with one black band, one yellow band, and one brown band.
19. The M49A1 trip flare is easily identified by its:
  - a. Aluminum body and black markings.
  - b. Mounting bracket safety clip and hand-grenade-type safety lever.
  - c. Body of natural kraft paper and black markings.
  - d. Nailing bracket, length of approximately 4 inches, and body of kraft paper.
20. Which pyrotechnic can be identified by its red filler plug?
  - a. Simulator, projectile, groundburst, M115.
  - b. Simulator, hand grenade, M111.
  - c. Simulator, flash, artillery, M110.
  - d. Detonation simulator, M80.

Recheck your answers to the Review Exercises. When you are satisfied that you have answered every question to the best of your ability, check your answers against the Exercise Solutions. If you have missed six or more questions, you should retake the entire subcourse, paying particular attention to the areas in which your answers were incorrect.

**EXERCISE SOLUTIONS**

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1. b (page 10)
2. c (page 9)
3. c (page 12)
4. c (page 14)
5. a (page 22)
6. b (page 27)
7. c (page 25)
8. c (page 31)
9. d (page 32)
10. a (page 40)
11. d (page 41)
12. b (page 42)
13. d (page 42)
14. a (page 44)
15. d (page 51)
16. d (page 67)
17. b (page 68)
18. b (Figure 76, page 57)
19. b (page 71)
20. c (Figure 109, page 77)